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SURVEY OF INDUSTRIAL WASTE INJECTION WELLS. VOLUME II

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SURVEY OF INDUSTRIAL WASTE INJECTION WELLS

VOLUME II

by
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June 1972

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POTENTIAL WIDE-INTEREST REPORT

WARNING TO EVALUATORS FROM INPUT

DOCUMENT WILL REPRODUCE POORLY

37
147
~~252~~
303
411
421
528
651
669

DECISION BY EVALUATORS:

1. Accepted as wide-interest report ______________________
Signature

2. Accepted as regular report ______________________
Signature

3. Return to source ______________________
Signature

I. Operating Company & General Well Location

Pontchartrain Works, E.I. DuPont de Nemours, & Co. St. John the Baptist Parish, LaPlace, Louisiana. The site is located on the east bank of the Mississippi River between LaPlace and Reserve, Louisiana.

II. Well location (legal description)

Fee "D" S.W.D.; No. 2; Sec. 90; T-11S; R 7E; St. John the Baptist Parish (normally referred to as Pontchartrain Works Disposal Well No. 2)

III. History; system planning, construction & operation.

The No. 2 well was drilled and completed under Louisiana Department of Conservation work permit No. S.W.D. D #7. Completion date was November 24, 1964. The well completion was designed for injection of aqueous brine material resulting from the production of nylon intermediates and neoprene. Surface facilities including storage, feed lines, filters, and appropriate instrumentation are provided handling the material.

Injection was commenced on November 24, 1964. Operation of this facility has been on a non-continuous basis.

IV. Geology & Geohydrology

A. Regional geologic setting: Monoclinal dip with maximum dip of 140 feet per mile at 6000' in a south-southwest direction. The well is located on the east flank of the Mississippian embayment which is on the southern margin of the Gulf Coastal Plain. The area in which the well is located has a monoclinal dip with a maximum dip of 140 ft. per mile in a south-southwest direction. The stratigraphic section consists of Miocene through Recent sands, clays, and shales.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).

(Ground elevation 17 ft. above sea level) (Total well depth 5237 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
~~Miocene & Younger~~			5237 ft.	sand & Shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
5000 ft.	Miocene	5050 ft.	100	Sand - Infinite
4800 ft.	Miocene	4770 ft.	210	Sand - Infinite
4600 ft.	Miocene	4450 ft.	200	Sand - Infinite
4100 ft.	Miocene	3965 ft.	175	Sand - Infinite
3800 ft.	Miocene	3752 ft.	150	Sand - Infinite
3000 ft.	Miocene	2895 ft.	105	Sand - Infinite
2600 ft.	Miocene	2475 ft.	290	Sand - Infinite
2400 ft.	Miocene	2285 ft.	145	Sand - Infinite
2100 ft.	Miocene	2050 ft.	[illegible]	Sand - Infinite
1900 ft.	Miocene	1850 ft.	80	Sand - Infinite

D. Engineering description of injection units

1. Porosity: 32.5% at the 5,000 ft. sand; 35% (Estimated) at the 3800 ft.
2. Permeability: 1250 MLD* at 5000 ft; 1500 MLD at 4600 ft.
3. Original Reservoir Pressure: 2312 PSI at 5162 ft. (Measured)
4. Reservoir Temperature: 122°F @ 5237 feet. (measured)
5. Chemical Character of Formation Water: These samples were taken at 5022' in DuPont's No. 1 Disposal Well[1]

Chloride Ion - NaCl - 3.4%		Iron -	2.4 PPM
Hardness as $CaCO_3$ - 1990 PPM		Total Dissolved Solids-	3.5%
Sulfate Ion -	1440 PPM	PH -	8.49

6. Reservoir Fracture Pressure; 4645 PSI at 5162 ft. (0.9 #/ft. gradient)

1 These samples could have been contaminated by fluid used in the well work activity.

* MLD stands for Millidarcys.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
[illegible]llow Sands	0-800 ft.	[illegible] ft.	Sand	No Data

F. Mineral Resources (oil and gas, coal, brines, etc.)

None

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	16"	H-40 Casing	16"	68 ft.	
Intermed.	15"	23# Protective Casing	10 3/4"	1030.00 ft.	620 sacks o[f] common port[land] cement
Injection		26# Injection Casing	7"	5225.7 ft.	900 sacks of common port[land] cement

Other None

Describe bottom hole completion method: The casing is perforated

1 - From 3790 ft. to 3850 ft. 3 - From 4617 ft. to 4647 ft.
2 - From 4587 ft. to 4617 ft. 4 - From 5150 ft. to 5180 ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

1 - A tubing packer.

2 - A differential valve tool was placed at 3034 feet.

3 - Spring steel centralizers were run on 90 ft. spacing on the 7 inch casing.

VI. Description of surface equipment

A. Holding tanks & flow lines Storage tanks and a clairifier pro combined holdup time of approximately 1.5 days. This is combined wi additional storage surge capacity to handle up to 10 inches of rain. This system is also used for blending the waste material.

B. Filters Primary and secondary filters are provided to remove solids down to 10 microns.

C. Pumps 2 stage centrifugal pumps

D. Other Pressure relief protection is provided along with instrumentation to monitor and record pressure and flow continuously

VII. Cores, samples, & Logs

A. Coring

	From	to	Recovery
From	No cores	none	none
"	No cores	none	none
"	No cores	none	none
"	No cores	none	none
"	No cores	none	none
"	No cores	none	none

B. Drilling Logs

___ Drillers Log ___ Drilling time

___ Sample log none ___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

_x_Caliper ___Cement bond

___Other Electric, casing inspection, and microlog

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of nylon intermediates and neoprene.

B. Physical & chemical Description Sodium chloride brine with miscellaneous ingredients.

NaCl .... 5%-20% PH .,........ 7-11

Cyanide .... 0-500 PPM Density 1.05-1.20

Copper .... 0-100 PPM

Nitriles (as Adiponitrile). 0-500 PPM

Ammonia .... 50-150 PPM

Dissolved Solids 6%-22%

C. Volume 250,000 pounds per hour = 28,100 gallons per hour; 670 barrels per hour

IX. . Preinjection waste treatment Material blending, PH and chemical treatment and solids separation and removal are provided.

Well operation & operating history

A. Tests

* Sample data taken during normal operation.

Type	Duration	Zones tested	Description of test results
11-20-64	one hour *	4,587 ft.-4,617 ft.	50,000 lbs/hr.@ 325 PS
11-18-68*	7 hours *		21,400 lbs/hr.@1,500 PS
3-4-70	one hour *		150,000 lbs/hr.@ 85 PSI
10-14-70	one hour *		125,000 lbs/hr.@ 200 PSI
11-16-70	one hour *		100,000 lbs/hr.@ 80 PSI
2-25-71	one hour *		30,000 lbs/hr.@ 120 PSI
6-1-71	one hour *		185,000 lbs/hr.@ 250 PSI
6-5-71	one hour *		160,000 lbs/hr.@ 250 PSI
6-10-71	one hour *		90,000 lbs/hr.@ 120 PSI
6-14-71	one hour *		75,000 lbs/hr.@ 200 PSI

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
4,587ft.-4,617ft.	Acidize with 15% HCL	2000 gallons of 15% HCL-Unsuccess
4,617ft.-4,647ft.	Perforate with 4 shots per ft.	Bullet charges - Good
4,635ft.-4,665ft.	Perforate with 4 shots per ft.	Bullet charges - Good
4,635ft.-4,665ft.	Acidize with 3% HF-10% HCL	7500 gal. of HF. - Good
4,635ft.-4,665ft.	Acidize with 6% HF-10% HCL	2000 gal. of "Super" HF- Goo
3,790ft.-3,850ft.	Perforate with 8 shots per ft.	Bullet charges-Unsuccess
3,790ft.-3,850ft.	Acidize with 6% HF-10% HCL	2000 gal. of "Super" HF-Good

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum
6-1-71	Average	180,000 lbs/hr.	Maximum	185,000 lbs/hr
6-5-71	"	160,000 lbs/hr	"	180,000 lbs/hr
6-10-71	"	140,000 lbs/hr	"	175,000 lbs/hr
6-12-71	"	155,000 lbs/hr	"	165,000 lbs/hr
6-14-71	"	100,000 lbs.hr	"	150,000 lbs/hr

2. Pressure (well head x bottom hole)

Date(s)		Average		Maximum
6-1-71	Average	250 PSIG	Maximum	270 PSIG
6-5-71	"	250 PSIG	"	280 PSIG
6-10-71	"	250 PSIG	"	310 PSIG
6-12-71	"	190 PSIG	"	350 PSIG
6-14-71	"	200 PSIG	"	380 PSIG

* No. 2 well was dually completed. The first stage is in the 3790 ft. to 3850 ft. zone and is used for NaCL brine disposal. It was perforated on 3-18-67. The second stage is in the 5150 ft. to 5180 ft. zone and is used for disposal of hydrocarbons resulting from the manufacture of nylon intermediates and neoprene. It was perforated on 4-21-68. No. 2 well was also perforated from 4587 ft. to 4617 ft. on 4-13-65 and from 4617 ft. to 4647 on 6-22-65. The 5150 ft. to 5180 ft. zone is not being used currently.

X. Well operation & operating history

D. Description of operating programs: The No. 2 well is used alternately with wells No. 1 and No. 3 to inject waste material from the process.

E. Operating problems: Material injection rate restrictions have necessitated occasional cleaning and backwash operations.

XI. Regulatory aspects. (See Note Below)

A. Construction requirements The well casing was cemented from the bottom shoe to the surface using a differential valve tool. The casing was perforated at the desired injection zone.

B. Monitoring requirements Injection pressure and volume of waste injected are recorded.

C. Restrictions on operating procedure Control of injection pressures, material composition, PH, temperature and solids content are maintained.

NOTE: Items listed in section XI include those required by the state and normal practices followed during operation.

XII. Economics

A. Total & unit costs of construction Original completion costs approximately $ 17,000.

B. Operating costs Combined operating costs for brine disposal wells 1-4 and their related pre-injection treatment steps (including well workover operations) are about $900,000/yr.

XIII. Source(s) of Information and Published References Company files and Pollution Control and Waste Disposal Inc.; Consulting Service.

I. Operating Company & General Well Location

Pontchartrain Works, E. I. du Pont de Nemours and Company. St. John the Baptist Parish, La Place, Louisiana. The site is located on the East Bank of the Mississippi River between La Place and Reserve, Louisiana.

II. Well Location (Legal Description)

Sec. [illegible], [illegible]; St. John the Baptist Parish (formerly referred to as Pontchartrain Works Disposal Well No. 1)

III. History: system planning, construction & operation.

The No. 1 well was drilled and completed under Louisiana Department of Conservation Work Permit No. [illegible]. Completion date was May 12, 1961. The well completion was designed for injection of aqueous brine [illegible] resulting from the production of nylon intermediates and neoprene. Surface facilities including storage, feed lines, filters, and appropriate instrumentation are provided for handling the material.

Injection was commenced on November 21, 1967. Operation of this facility has been on a [illegible] basis.

IV. Geology & Geohydrology

A. Regional geologic setting. Monoclinal dip with maximum dip of 150 feet per mile at [illegible] ft. in a south-southwest direction. The well is located on the east flank of the Mississippian embayment which is on the southern margin of the Gulf Coastal Plain. The area in which the well is located has a monoclinal dip with a maximum dip of 150 ft. per mile in a south-southwest direction. The stratigraphic section consists of Miocene through Recent sands, clays, and shales.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes x ; no ____).

(Ground elevation 17.3 Ft. above sea level) (Total well depth 5243 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Miocene & Younger		0-5243 Ft.	5243Ft.	Sand & Shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
5000 Ft. Sd.	Miocene	5108 Ft.	135 Ft.	Sand & Infinite
4800 Ft. Sd.	Miocene	4800 Ft.	230 Ft.	Sand & Infinite
4600 Ft. Sd.	Miocene	4500 Ft.	180 Ft.	Sand & Infinite
4100 Ft. Sd.	Miocene	4045 Ft.	335 Ft.	Sand & Infinite
3800 Ft. Sd.	Miocene	3792 Ft.	138 Ft.	Sand & Infinite
3000 Ft. Sd.	Miocene	2925 Ft.	105 Ft.	Sand & Infinite
2600 Ft. Sd.	Miocene	2505 Ft.	290 Ft.	Sand & Infinite
2400 Ft. Sd.	Miocene	2409 Ft.	41 Ft.	Sand & Infinite
2100 Ft. Sd.	Miocene	2060 Ft.	170 Ft.	Sand & Infinite
1900 Ft. Sd.	Miocene	1868 Ft.	88 Ft.	

D. Engineering description of injection units

1. Porosity: 32.5% at the 5000 ft. sand 35.0% at the 3800 Ft. 30.0% at the 4800 ft. Sand
2. Permeability: 1250 Mld. at 5000 feet 2000 Mld. at 3800 Ft. ~~750 Mld. at 4800 feet~~
3. Original Reservoir Pressure: 2343 psi - Calculated
4. Reservoir Temperature: 130°F at 5243 feet (measured)
5. Chemical Character of Formation Water: These samples were taken at 5022 ft. in Du Pont's No. 1 Disposal Well.[1]

Chloride Ion (NaCl)	3.4%
Hardness as $CaCO_3$	1990 PPM
Sulfate Ion	1440 PPM
Iron	2.4 PPM
Total Dissolved Solids	3.50%
pH	8.49

6. Reservoir Fracture Pressure: 4717 psi (at 0.9 psi/ft)

[1] These samples could have been contaminated by fluid used in the well work activity.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Shallow Sands	0-800Ft.	800Ft.	Sand	No Data

F. Mineral Resources (oil and gas, coal, brines, etc.)

None

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	16"	H-40	13"	100.00Ft.	
Intermed.	15"	J-55	10 3/4"	1048.0Ft.	715 sacks of Portland plus 4% gel 3% CaCl
Injection		J-55-26 lbs.	7"	5226.18Ft.	1,900 cu.ft. of slurry composed

50% common Portland cement, 50% Pozmix A, and 2% gel.

Other None

Describe bottom hole completion method: The casing is perforated

From 3820 Ft. to 3860 Ft. From 4872 Ft. to 4932 Ft.

From 3860 Ft. to 3920 Ft. From 5130 Ft. to 5170 Ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

1 - No Packers

2 - Spring steel centralizers were run on 90 ft. spacing on the 7.0" casing

3 - A 10 3/4" OD x 7" OD gray well head assembly

VI. Description of surface equipment

A. Holding tanks & flow lines Storage tanks and a clarifier provide combined holdup time of approximately 1.5 days. This is combined with additional storage surge capacity to handle up to 10 inches of rainfall. This system is also used for blending the waste material.

B. Filters Primary and secondary filters are provided to remove solids down to 10 microns.

C. Pumps 2 stage centrifugal pumps

D. Other Pressure relief protection is provided along with instrumentation to monitor and record pressure and flow continuously.

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
No Cores	None	None
No Cores	None	None
No Cores	None	None
No Cores	None	None
No Cores	None	None
No Cores	None	None
No Cores	None	None

B. Drilling Logs

___ Drillers Log ___ Drilling time

___ Sample log ___ Other:

II. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity	_X_Gamma ray-neutron
___SP	___Temperature
_X_Caliper	___Cement bond

___Other [illegible] log, [illegible], collar log & perforat

III. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of nylon intermediates and neoprene

B. Physical & chemical Description Sodium chloride brine with miscellaneous ingredients.

NaCl........................[illegible]

Cyanide....................[illegible] Dissolved Solids...6% - 12%

Copper.....................[illegible] PH................ 7-11

[illegible]..[illegible] Density............ 1.04-1.20

Ammonia.................... [illegible]

C. Volume 220,000 pounds per hour = 26,100 gallons per hour, 620 barrels per hour.

. Preinjection Waste Treatment Material blending, pH and chemical treatment, and solids separation and removal are provided.

7. Well operation & operating history

A. Tests

Date	Duration	Zones tested	Description of test results
11-23-67	1 [illegible] *	[illegible] Ft.-[illegible]Ft.	[illegible] psig
3-10-69	1 Hour *	3900 Ft.-[illegible]Ft.	220M pph 110.0 psig
4-24-69	1 Hour *	3900 Ft.-[illegible]Ft.	170M pph [illegible]0.0 psig
5-[illegible]-69	1 Hour *	3860 Ft.-3920Ft.	190M pph 1[illegible]0.0 psig
4-15-70	1 Hour *	3860 Ft.-3920Ft.	160M pph 255 psig
6-17-70	1 Hour *	3860 Ft.-3920Ft.	220M pph 190 psig
7-1[illegible]-70	1 Hour *	3860 Ft.-3920Ft.	70M pph 287 psig
3-29-71	1 Hour *	4872 Ft.-4912Ft.	90M pph 220 psig
4-29-71	1 Hour *	4872 Ft.-4912Ft.	170M pph 200 psig
7-12-71	1 Hour *	4872 Ft.-4912Ft.	115M pph 260 psig

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
60	[illegible] Ft.-3960 Ft. Reperforation	Successful
69	3860 Ft.-3920 Ft. Reperforation	Not Successful
69	3860 Ft.-3920 Ft. Acidizing [illegible]	Successful
70	3860 Ft.-3920 Ft. Nitrogen lift - Backwashing	Successful
70	4872 Ft.-4912 Ft. Perforation 4 shots/ft.	Successful
71	4872 Ft.-4912 Ft. Nitrogen lift - Backwashing	Successful
71	[illegible] - High pressure perforation	

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum
3-29-71	Average	[illegible]Mlbs/hr.	Maximum	[illegible]Mlbs/hr.
4-11-71	"	100Mlbs/hr.	"	100Mlbs/hr.
5-2-71	"	110Mlbs/hr.	"	1[illegible]Mlbs/hr.
6-25-71	"	105Mlbs/hr.	"	115Mlbs/hr.
7-12-71	"	115Mlbs/hr.	"	133Mlbs/hr.

2. Pressure (well head ___X___ bottom hole ________)

Date(s)		Average		Maximum
3-30-71	Average	205 psig	Maximum	275 psig
4-11-71	"	130 psig	"	160 psig
5-9-71	"	240 psig	"	270 psig
6-25-71	"	140 psig	"	160 psig
7-12-71	"	260 psig	"	270 psig

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* Sample data taken during normal operations.

X. Well operation & operating history

D. Description of operating procedure: The No. 3 well is used alternately with wells No. 1 and No. 2 to inject waste material from the process.

E. Operating problems: Material injection rate restrictions have necessitated occasional cleaning and backwash operations.

XI. Regulatory aspects. (see note below)

A. Construction requirements: The well casing was cemented from the bottom shoe to the surface using a differential valve tool. The casing was perforated at the desired injection zone.

B. Monitoring requirements: Injection pressure and volume of waste injected are recorded.

C. Restrictions on operating procedure: Control of injection pressures, materials composition, pH, temperature and solids content are maintained.

NOTE: Items listed in section XI include those required by the state and normal practices followed during operation.

XXII. FINANCIAL

A. Total & unit costs of construction Original completion cost approximately $[illegible],000.

B. Operating Costs Combined operating costs for both disposal wells 1-2 and their related pre-injection treatment steps (including well workover operations) are about $[illegible],000/yr.

XXIII. Source(s) of Information and Published References Company files and Pollution Control and Waste Disposal Inc., Consulting Service.

I. Operating Company & General Well Location

Pontchartrain Works, E.I. duPont de Nemours, and Company St. John the Baptist Parish, LaPlace, Louisiana. The site is located on the east bank of the Mississippi River between LaPlace and Reserve, Louisiana

II. Well location (legal description)

Sec. 13, [illegible] St. John the Baptist Parish (currently referred to as Pontchartrain Works Disposal Well No. 3)

III. History, system planning, construction & operation.

The No. 4 well was drilled and completed under Louisiana Department of Conservation Work Permit No. [illegible]. Completion date was October 11, 1969. The well completion was designed for injection of aqueous brine material resulting from the production of nylon intermediates and monomers. Surface facilities including storage, feed lines, filters, and appropriate instrumentation are provided for handling the material.

Injection was commenced on October 31, 1969. Operation of this facility has been on a [illegible] basis.

IV. Geology & Geohydrology

A. Regional geologic setting: Monoclinal dip with maximum dip of 140 feet per mile at 6000 ft. in a south - southwest direction. The well is located on the east flank of the Mississippian embayment which is on the northern margin of the Gulf Coastal Plain. The area in which the well is located has a monoclinal dip with a maximum dip of 140 ft. per mile in a south-southwest direction. The stratigraphic section consists of Miocene through Recent sands, clays, and shales.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column Included—yes x ; no ___).

(Ground elevation [illegible]) (Total well depth 4200 ft.)

Datum for depth measurement ground level

Name	Age	Depth (top)	Thickness	Lithologic Description
[illegible]		0-4200 ft.	4200 ft.	sand & shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

D. Engineering description of injection units

1. Porosity: [illegible]
2. Permeability: [illegible] MD* at 4000 ft; [illegible] MD at [illegible] ft.
3. Original Reservoir Pressure: [illegible] PSIG (Calculated)
4. Reservoir Temperature: [illegible] (measured)
5. Chemical Character of Formation Water: Three samples were taken at [illegible] ft. in [illegible] No. 1 disposal well.[1]
   [illegible] .... [illegible]
   [illegible] .... [illegible]
   [illegible] .... [illegible]
   [illegible] .... [illegible]
   Total dissolved solids .... [illegible]

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6. Reservoir Fracture Pressure: [illegible] PSI ([illegible] psi/ft.)

1 Three samples could have been contaminated by fluids used in the well work activity.

*MD stands for millidarcys.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
[illegible] sands	[illegible]	[illegible] ft.	[illegible]	No Data

F. Mineral Resources (oil and gas, coal, brines, etc.)

[illegible]

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12.0 in.	[illegible]	10 3/4in.	[illegible]	[illegible]
Intermed.	[illegible]	[illegible]	7 in.	[illegible]	[illegible]
Other	[illegible]				

Describe bottom hole completion method: [illegible] in. O.D. stainless steel, [illegible] screen is installed [illegible] sacks of [illegible] x [illegible] mesh gravel held in place with a [illegible] ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

1. A tubing packer is installed.

2. Spring steel centralizers were run on 90' spacing on the 7.0" casing.

3. A 10 3/4 in. O.D. X 7 in. O.D. X 4½ in O.D. gray well head assembly.

VI. Description of surface equipment

A. Holding tanks & flow lines Storage tanks and a clarifier provide combined holdup time of approximately 1.5 days. This is combined with additional storage surge capacity to handle up to 10 inches of rainfall. This system is also used for blending the waste material.

B. Filters Primary and secondary filters are provided to remove solids down to 10 microns.

C. Pumps 2 stage centrifugal pumps.

D. Other Pressure relief protection is provided along with instrumentation to monitor and record pressure and flow continuously

VII. Cores, samples, & logs

A. Coring

From	to	Recovery
no cores	no cores	no cores
no cores	no cores	no cores
no cores	no cores	no cores
no cores	no cores	no cores
no cores	no cores	no cores
no cores	no cores	no cores

B. Drilling Logs

___Drillers Log ___Drilling time

___Sample log None ___Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity

___SP

X Caliper

___Other Induction - Electric

___Gamma ray-neutron

___Temperature

___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of nylon intermediates and neoprene.

B. Physical & chemical Description Sodium chloride brine with miscellaneous ingredients.

NaCl .... 5%-20%   PH 7-11

Cyanide .... 0-500 PPM   Density ..... 1.05-1.2 gms

Copper .... 0-100 PPM

Nitriles (as Adiponitrile). 0-200 PPM

Ammonia .... 50-150 PPM

Dissolved Solids 6%-22%

C. Volume 250,000 pounds per hour - 28,100 gallons per hour - 670 barrels per hour.

IX. Preinjection waste treatment Material blending, PH and chemical treatment and solids separation and removal are provided.

X. Well operation & operating history

A. Tests

Type	Duration	4891-4957 Zones tested	Description of test results
11-1-69	1 Hour *	4832 Ft. to 4957 Ft.	75,000 lbs/hr. @ 0 PSIG
2-26-70	1 Hour *	4832 Ft. to 4957 Ft.	110,000 lbs/hr. @ 24 PSIG
3-25-70	1 Hour *	4832 Ft. to 4957 Ft.	100,000 lbs/hr. @ 0 PSIG
4-19-70	1 Hour *	4832 Ft. to 4957 Ft.	115,000 lbs/hr. @ 0 PSIG
6-14-70	1 Hour *	4832 Ft. to 4957 Ft.	110,000 lbs/hr. @ 132 PSIG
9-15-70	1 Hour *	4832 Ft. to 4957 Ft.	100,000 lbs/hr. @ 348 PSIG
2-10-71	1 Hour *	4832 Ft. to 4957 Ft.	80,000 lbs/hr. @ 168 PSIG
3-16-71	1 Hour *	4832 Ft. to 4957 Ft.	90,000 lbs/hr. @ 360 PSIG
4-11-71	1 Hour *	4832 Ft. to 4957 Ft.	85,000 lbs/hr. @ 420 PSIG
7-31-71	1 Hour *	4832 Ft. to 4957 Ft.	72,000 lbs/hr. @ 456 PSIG

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
4789 ft.	Acidizing	3000 gal. of 15% HCL - Good
70 4789 ft.	Backwashing	Nitrogen Lift Method - Good
70 4789 ft.	Rework & Washout	Scraping and washing - Good

C. Injection rates and pressures

1. Rate

Date(s)		Average	Maximum
Date(s)	2-24-71	76,000 lbs/hr.	90,000 lbs/h
"	3-28-71	105,000 lbs/hr	100,000 lbs/h
"	4-28-71	100,000 lbs/hr	100,000 lbs/
"	6-7-71	100,000 lbs/hr	100,000 lbs/
"	7-21-71	74,000 lbs/hr.	75,000 lbs/h

2. Pressure (well head X bottom hole ______)

Date(s)		Average	Maximum
Date(s)	5-24-71	144 psig	257 psig
"	3-28-71	324 psig	324 psig
"	4-28-71	372 psig	372 psig
"	6-7-71	276 psig	276 psig
"	7-21-71	456 psig	456 psig

*Sample data taken during normal operations.

X. Well operation & operating history

D. Description of operation sequence: The No. 4 well is used independently of the other wells. Design flexibility allows wells 1, 2, and 3 to serve as a back-up for No. 4

E. Operating problems: Material injection rate restrictions have necessitated occasional cleaning and backwash operations.

XI. Regulatory aspects. (See note below)

A. Construction requirements: The well casing was cemented from the bottom shoe to the surface using a differential valve tool. The injection zone design involves an underreamed area below the casing, gravel pack installation of a liner. A packer prevents the injected material from contacting the well casing. The annular space between the injection tubing and the casing was filled with a corrosion inhibitor to prevent corrosion of the metallic surfaces.

B. Monitoring requirements: Injection pressure and volume of waste injected are recorded.

C. Restrictions on operating procedure: Control of injection pressures and solids content.

NOTE: Items listed in section XI include those required by the state and normal practices followed during operation.

XII. Economics

A. Total & unit costs of construction Original completion cost approximately $150,000.

B. Operating costs Combined operating costs for brine disposal wells 1-4 and their related pre-injection treatment steps (including well work-over operations) are about $900,000/yr.

XIII. Source(s) of Information and Published References Company files and Pollution Control and Waste Disposal Inc.; Consulting Service.

I. Operating Company & General Well Location

E. I. du Pont de Nemours & Company, Pontchartrain Works, St. John the Baptist Parish. The site is located on the east bank of the Mississippi River between La Place and Reserve, La.

II. Well location (legal description)

Sec [illegible], [illegible] No. 6 Sec. [illegible] T-11S; R-7E; St. John the Baptist Parish. (Formerly referred to as Pontchartrain Works Disposal Well No. 6)

III. History; system planning, construction & operation.

The No. 6 well was drilled and completed under Louisiana Department of Conservation Work Permit No. SWD-16. Completion date was September [illegible], [illegible]. The well completion was designed for injection of chlorinated hydrocarbon material with surface facilities including [illegible], feed lines, and appropriate instrumentation. Operation was commenced December 15, 1969. Operation of this well [illegible] on a non-continuous basis with diesel oil injected as a clean liquid between periods of injection.

IV. Geology & Geohydrology

A. Regional geologic setting: Monoclinal dip with maximum dip of 140 feet per mile at [illegible] ft. in a south-southwestward direction.

The well is located on the east flank of the Mississippian embayment which is on the southern margin of the Gulf Coastal Plain. The area in which the well is located has a monoclinal dip with a maximum dip of 140 ft. per mile in a south-southwest direction. The stratigraphic section consists of Miocene through Recent sands, clays, and shales.

[illegible] 15 Ft. above [illegible] Ground Level [illegible] 6510 Ft.

[illegible] Ground Level

Name	Age	Depth (Top)	Thickness	Lithologic Description
Miocene & Younger			6516 Ft.	Sand and Shale

C. Geologic Description of Injection units & possible units [illegible]

Rock Unit

Name	Age	Depth (Top)	Thickness	Character and Areal Distribution
6500 Ft.	Miocene	6432	75 Ft.	Sand-Infinite
6000 Ft.	"	[illegible]	[illegible]	Sand-Infinite
[illegible] Ft.	"	[illegible]	50 Ft.	Sand-Infinite
[illegible] Ft.	"	[illegible]	150 Ft.	Sand-Infinite
4800 Ft.	"	[illegible]	120 Ft.	Sand-Infinite
4600 Ft.	"	[illegible]	170 Ft.	Sand-Infinite
4100 Ft.	"	4048	222 Ft.	Sand-Infinite
3800 Ft.	"	3772	150 Ft.	Sand-Infinite
3000 Ft.	"	[illegible]	104 Ft.	Sand-Infinite
2600 Ft.	"	2490	400 Ft.	Sand-Infinite
2400 Ft.	"	2370	90 Ft.	Sand-Infinite
2100 Ft.	"	[illegible]	180 Ft.	Sand-Infinite
1990 Ft.	"	1870	70 Ft.	Sand-Infinite

D. Engineering description of injection units

1. Porosity: 6500 Ft. SD-[illegible]%; 6000 Ft. SD-29.5%
2. Permeability: 6500 Ft. SD-2000 MLD; 6000 Ft. SD-2600 MLD
3. Original Reservoir Pressure: 2909# @ 6510 Ft. (0.447/ft) Calcul[illegible]
   2312# @ 5162 Ft. (Measured)
4. Reservoir Temperature: 135° @ 6516 Ft. (measured)
5. Chemical Character of Formation Water: These samples were taken @ 5122 Ft. in Du Pont's No. 1 Disposal Well.*

Chloride Ion-NaCl	3.4%
Hardness (as $CaCO_3$)	1990 PPM
Sulfate Ion	1440 PPM
Iron	2.4 PPM
Total Dissolved Solids	3.5%
P.H.	8.49

6. Reservoir Fracture Pressure: 5200# @ 6500 Ft. (.8)

*These samples could have been contaminated by fluid used in the well work activity.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Flow Sands	800 Ft.	800 Ft.	Sand	No Data

F. Mineral Resources (oil and gas, coal, brines, etc.)

None

V. Well design and construction

	Hole Size	Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
[illegible]face:	11 Ft.	32.75#/Ft. H-40	9 5/8"	1000 Ft.	Class A-150 Sacks with 2% CaCl 50/5[illegible] Pozmix - 670 Sack[illegible] with 2% Gel & 2% CaCl
[illegible]:	8 3/4"	17.0#/Ft. J-55	5 1/2"	6497 Ft.	1. 0-2722 Ft.,50-[illegible] Pozmix-770 Sac[illegible] 2. 2722 - Bottom 1) 50-50 Pozmix 825 sacks. 2) 100 Sacks of [illegible] Class A with .[illegible] 1% HR_4 Retar[illegible]

[illegible]: Differential valve tool @ 2722 ft. cemented to the surface with [illegible] sacks of 50-50 Pozmix. 2 3/8" stainless steel lined tubing set on a [illegible]osion resistant packer with a 2 3/8" slotted Hastelloy C liner.

[illegible]: Bottom 80 ft. of 5 1/2" casing is stainless steel.

[illegible]ibe Bottom Hole Completion Method: The casing is set on top of the [illegible]

V. Well design and construction, continued A.

B. Packers, Centralizers, well head equipment, etc:

1-Liner Packer

2-Tubing Packers

3-Spring steel centralizers were run on 90 ft. spacing on the 5 1/2" casing.

4-The well head equipment is 9 5/8" x 5 1/2" x 2 3/8" Gray Tool Co Assembly.

VI. Description of surface equipment

A. Holding tanks & flow lines Holding tank capacity provides approximately four days storage.

B. Filters Cartridge type are used to remove particles above 10 microns.

C. Pumps A positive displacement pump is used, having 50 gallons per minute capacity with 12-25 psig suction pressure and 2900 psig maximum discharge pressure.

D. Other The pump is equipped with a by-pass to control discharge pressure and relief protection against over pressurization.

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
No Cores	No Cores	
" No Cores	No Cores	
" No Cores	No Cores	
" No Cores	No Cores	
" No Cores	No Cores	
" No Cores	No Cores	
No Cores	No Cores	

B. Drilling Logs

X Drillers Log

No Sample log

X Drilling time

Other: IES; Density; Sonic; Synergetic, Perforating, Flowmeter; Collar

[illegible]

B. Other Logs Run

x Resistivity   x Radioactive Tracer

x SP   Temperature

x Caliper   Cement Bond

x Other: Sonic, Density, Gyroscopic, Flow, Perforating, Casing Caliper

VIII. Waste Characteristics

A. Industrial Process from which Waste is Derived

Manufacture of Nylon Intermediates and Neoprene

B. Physical & Chemical Description

Viscosity - 1 Centipoise

Waste - A mixture of high and low boiling hydrocarbon wastes from organic purification processes.

Density......1.10 to 1.20 gms/cc

Carbon....... 40 to 50%   Chlorine....... 45 to 55%

Hydrogen..... 5 to 10%   pH.............. Neutral

C. Volume Approximately 75,000 bal/yr.

IX. Preinjection Waste Treatment: The waste material is blended and filtered prior to injection.

[illegible]

A. [illegible] - Injection at 30 gallons/minute rate.

#	[illegible]	[illegible]	[illegible]	Description of [illegible]
[illegible]-70	Injection	1 Hour *	6[illegible]-6316'	750 psi - Diesel Oil
[illegible]-70	"	1 Hour *	[illegible]-6316'	1000 psi Diesel Oil
[illegible]-70	"	1 Hour *	6236'	1700 psi Diesel Oil
[illegible]-70	"	1 Hour *	[illegible]	1200 psi Waste
11-70	"	1 Hour *	[illegible]	1750 psi Waste
[illegible]-70	"	1 Hour *	[illegible]	2100 psi Waste
30-70	"	1 Hour *	[illegible]-6036'	0.0 psi Waste
27-70	"	1 Hour *	[illegible]-6036'	[illegible] psi Waste
[illegible]-71	"	1 Hour *	[illegible]	1175 psi Waste
[illegible]-71	"	1 Hour *	[illegible]	1950 psi Waste

B. [illegible]

Zones Treated	Treatment [illegible]	Description of Treatment and Results
6[illegible]-6316'	[illegible]	[illegible] - No Results
[illegible]	[illegible] & [illegible]	[illegible] - No Results
6006-6036'	Wash & [illegible]	No Results
6006-6036'	[illegible]	No Results
6006-6036'	Wash & [illegible]	No Results
6006-6036'	Wash & [illegible]	No Results
6006-6036'	[illegible]	In Operation

C. Injection rates and pressures.

1. Rate - 30 Gallons/Minute

Date(s)	6-10-71	Average	19 gpm	Maximum	30 gpm
"	6-25-71	"	25 gpm	"	26 gpm
"	7-7-71	"	26 gpm	"	26 gpm
"		"		"	
"		"		"	

2. Pressure (Well head ______ bottom hole ______)

Date(s)	6-10-71	Average	1000 PSIG	Maximum	1700 PSIG
"	6-25-71	"	1800 PSIG	"	1900 PSIG
"	7-7-71	"	1700 PSIG	"	1200 PSIG
"		"		"	
"		"		"	

* Sample data taken during normal operation.

X. Well operation & operating history

D. Description of operating program: No. 1 well is used alternately with No. 2 well. The well is flushed before and after each process injection with diesel oil.

E. Operating problems: Periodic injection rate restrictions have necessitated occasional cleaning and [illegible] operation.

XI. Regulatory aspects. (See note below)

A. Construction requirements: The well casing was cemented from the bottom shoe to the surface using a differential valve tool. The injection zone [illegible] an unfractured area below the casing, [illegible] of a liner. A packer prevents the injected material from contacting the well casing. The annular space between the injection tubing and the casing was filled with diesel oil to prevent corrosion of the metallic surfaces. Pressure on the casing is monitored.

B. Monitoring requirements: Casing pressure, injection pressure, and volume of waste are recorded. [illegible] inspections were made [illegible] and tubing.

C. Restrictions on operating procedure: Control of injection pressures and solids content.

NOTE: Items listed in section XI include those required by the state and [illegible] practices followed during operation.

XII. ECONOMICS

A. Total & unit costs of construction

Additional completion & stimulation: $170,000

B. Operating costs: Combined operating costs for No. 1 and No. 2 wells and their related pre-injection treatment plant (excluding well workovers) are about $300,000/yr.

XIII. Sources of Information and Published References

Company files and Pollution Control and Waste Disposal Inc., [illegible]

I. Operating Company & Current Well Location

E.I. DuPont de Nemours & Company, Pontchartrain Works, St. John the Baptist Parish. The site is located on the east bank of the Mississippi River [illegible] Louisiana.

II. Well Location (legal description)

Sec 13, [illegible] St. John the Baptist Parish (normally referred to as Pontchartrain Works Disposal Well No. 5)

III. History; system planning, construction & operation.

The No. 5 well was drilled and completed under Louisiana Department of Conservation [illegible] Permit No. [illegible]. Completion date was October 1, [illegible]. The well completion was designed for injection of chlorinated hydrocarbon material with surface facilities including storage, feed lines, and appropriate instrumentation.

Injection was commenced [illegible], 1970. Operation of this facility has been on a non-continuous basis with diesel oil injected as a flush liquid between periods of injection.

IV. Geology & Geohydrology

Regional geologic setting: Monoclinal dip with maximum dip [illegible] feet per mile at [illegible] ft. in a south-southwest direction. The well is located on the east flank of the Mississippi [illegible] embayment which is on the northern margin of the Gulf Coastal Plain. The area in which the well is located has a monoclinal dip with a maximum dip of 140 ft. per mile in a south-southwest direction. The stratigraphic section consists of Miocene through Recent sands, silts, and shales.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic [illegible] [illegible] yes X no ___).

(Ground elevation [illegible] (Total) well depth 5163 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (ft.)	Thick-ness	Lithologic Description
Miocene and Younger	[illegible]	5163 ft.		Sand and Shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (ft.)	Thick-ness	Character and Areal Distribution
[illegible] ft.	[illegible]	[illegible] ft.	[illegible] ft.	[illegible]
[illegible] ft.	[illegible]	[illegible] ft.	[illegible] ft.	[illegible]
[illegible] ft.	[illegible]	[illegible] ft.	[illegible] ft.	[illegible]
[illegible] ft.	[illegible]	[illegible] ft.	[illegible] ft.	[illegible]
[illegible] ft.	[illegible]	[illegible] ft.	[illegible] ft.	[illegible]
[illegible] ft.	[illegible]	[illegible] ft.	[illegible] ft.	[illegible]

Millidarcy

D. Engineering description of injection units

1. Porosity: [illegible] in 5000 ft. sand

2. Permeability: 1200 millidarcy in 5000 ft. sand

3. Original Reservoir Pressure: [illegible] psi @ 5000 feet. (Calculated)

4. Reservoir Temperature: 132° @ 5156 feet (Measured)

5. Chemical Character of Formation Water: These samples were [illegible] ft. in [illegible] No. 1 [illegible] well.*

Chloride Ion [illegible]	- [illegible]	Iron	- 2.4 PPM
Hardness as CaCO₃	- [illegible] PPM	Total Dissolved Solids	- 3.9%
Sulfate Ion	- [illegible] PPM	pH	- 8.45

6. Reservoir Pressure Pressure: [illegible] PSI (Calculated) at 5000 feet.

34 * These samples could have been contaminated by fluid used in the wel[l] work activity.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
[illegible] Sands	900 ft.	[illegible]-300 ft.	Sand	No Data

F. Mineral Resources (oil and gas, coal, brines, etc.)

None

V. Well design and construction

A. Casing, Tubing, and Cement.

	Hole Size	Casing or Tubing Weight & Grade		Size	Depth Set	Type & Amount of Cement
[illegible]	11"	32.75 #/ft.	H-40	9 5/8"	1050 ft.	Class A-150 s[illegible] of common
[illegible]	8 3/4"	17.0 #/ft.	[illegible]-55	5½"	6497 ft.	Stage 1. 786 [illegible] of pozmix-100 sacks of com[illegible] Stage 2. 600 of pozmix

[illegible]: A differential valve tool was set at 2285 ft. in order to cement the casing to the surface with 786 sacks of 50/50 pozmix plus 1[illegible] sacks of common. Stainless steel (2 3/8 in.) lined tubing was set on a corrosion resistant packer.

[illegible]: The bottom 50 ft. of 5½ inch casing is stainless steel.

[illegible] Hole Completion Method: The casing is set on top of the [illegible] sand. The injection interval is underreamed and the injection [illegible]

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Centralizers on 90 ft. spacing were run on 5½" casing and a stage cementing tool was used. Injection tubing was set on a wire line set packer above the liner packer. The well head is 9 5/8" X 5½" : 2 3/8" Gray Tool Company assembly.

VI. Description of surface equipment

A. Holding tanks & flow lines Holding tank capacity provides approximately four days storage.

B. Filters Cartridge type filters are used to remove particles above 10 microns.

C. Pumps A positive displacement pump is used, having 50 GPM capacity with 12-25 PSIG suction pressure and 2900 PSIG maximum discharge pressure.

D. Other The pump is equipped with a by-pass to control discharge pressure and relief protection against over pressurization.

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
No cores	None	None
" No cores	None	None
" No cores	None	None
" No cores	None	None
" No cores	None	None
" No cores	None	None

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: I.E.

VII -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ___Gamma ray-neutron

___SP ___Temperature

X Caliper ___Cement bond

___Other Electronic casing inspection

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of nylon intermediates and neoprene.

B. Physical & chemical Description

Viscosity - 4 centipoises

Waste - A mixture of high and low boiling hydrocarbon wastes from organic purification processes.

Density ... 1.10 to 1.20 gms/cc.

Carbon ... 40 to 45% Chlorine .... 45 to 55%

Hydrogen ... 5 to 10% PH .... Neutral

C. Volume Approximately 75000 gals./yr. maximum

IX. Preinjection waste treatment The waste material is blended and filtered prior to injection.

X. Well operation & operating history

A. Tests - Injection at 30 gallons/minute rate

DATE	Duration	Zones tested	Description of test results
6-28-70	9.5 Hours *	5104 ft.-5163 ft.	550 PSIG - Waste
6-30-70	7.5 Hours *	5104 ft.-5163 ft.	1150 PSIG - Waste
12-22-70	10.0 Hours *	5104 ft.-5163 ft.	1500-1600 PSIG- Waste
2-2-71	Attempted	5104 ft.-5163 ft.	2900 PSIG - Waste
3-20-71 to 4-7-71	Clean out operation	5104 ft.-5163 ft.	1600-1700 PSIG-Waste
5-22-71	15.0 Hours *	5080 ft.-5091 ft.	1600-1700 PSIG-Waste

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
5081 Ft. - 5091 Ft.	Washing, gravel packing, and acidizing	Hydrojet perforation technique. successful

C. Injection rates and pressures

1. Rate 30 gallons/minute

Date(s)	Average	Maximum
5-25-71	17.2 M#/hr.	17.2 M#/hr.
5-30-71	13.0 M#/hr.	13.0 M#/hr.
6-1-71	17.4 M#/hr.	17.4 M#/hr.

2. Pressure (well head x bottom hole)

Date(s)	Average	Maximum
5-25-71	1675 PSIG	1700 PSIG
5-30-71	1700 PSIG	1700 PSIG
6-1-71	1750 PSIG	1800 PSIG

* Sample data taken during normal operation.

X. Well operation & operating history

D. Description of operating programs: The No. 5 well is used alternately with No. 6 well. The well is flushed before and after each waste process injection with diesel oil.

E. Operating problems: Material injection rate restrictions have necessitated occasional cleaning and backwash operations.

XI. Regulatory aspects. (See Note Below)

A. Construction requirements The well casing was cemented from the bottom shoe to the surface using a differential valve tool. The injection zone design involves an underreamed area below the casing, a gravel packing. A packer prevents the injected material from contact the well casing. The annular space between the injection tubing and ~~(continue on bottom of page)~~

B. Monitoring requirements Casing pressure, injection pressure, and volume of waste injected are recorded. Electronic casing inspections were made to check the casing and tubing.

C. Restrictions on operating procedure Control of injection pressures and solids content.

the casing is filled with diesel oil to prevent corrosion of the metallic surfaces. Pressure on the casing is monitored.

NOTE: Items listed in section XI include those required by the state and normal practices followed during operation.

A. Total & unit costs of construction
Original completion approximately $130,000.

B. Operating costs Combined operating costs for No. 5 and No. 6 wells and their related pre-injection treatment steps (including well workover operations) are about $300,000/yr.

III. Source(s) of Information and Published References
Company files and Pollution Control and Waste Disposal Inc.; Consulting Service.

I. Operating Company & General Well Location

American Cyanamid Company disposal well No. 1 operated by American Cyanamid Company is located on their Fortier plantation in Jefferson Parish, Louisiana.

II. Well location (legal description)

Latitude - [illegible] N

Longitude - 90° [illegible] W

Section 5, T13S, R21E, Jefferson Parish

[illegible] from NW corner of Section 5, T13S, R21E on bearing [illegible]

III. History, system planning, construction & operation.

In 1964, American Cyanamid Company began planning a new acrylonitrile facility here at our Fortier plant. The study indicated that technology was not available for a treatment facility for the cyanide waste which was generated by this new facility. It was determined that the only feasible disposal system was that of disposal by deep wells. Feasibility and compatibility studies were undertaken by a consulting engineer in 1965 for this deep well facility. Compatibility of the waste with the natural waters from the anticipated disposal zone indicated the project was feasible. Design was done by Walk-Haydel of New Orleans and the installation of the well was done under the direction of Cyanamid's Engineering and Construction Division and Walk-Haydel. This well has served as a standby for non-corrosive waste from the plant. Operation has been trouble free and workover has not been required since its completion.

IV. Geology & Hydrogeology

A. Regional geologic setting:

The well is located in the southern margin of the Gulf Coastal Plain. The well penetrates a large regional anomaly associated with a southerly plunging syncline. The stratigraphic section consists of massive Tertiary and Quaternary sands, clays, and shales.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes X ; no___).

(Ground elevation 5.0') (Total well depth 2721)

Datum for depth measurement [illegible] to G.L. - 10.65'

Name	Age	Depth (top)	Thickness	Lithologic Description
Undifferentiated	Recent Pleistocene	0'	1000'	Alternating shale and massive fresh water sand sequence
Undifferentiated	Pleistocene and Pliocene	1000'	1360'	Alternating shale and massive brackish and salt water sand sequence
2400' sand	Pliocene	2360'	135'	Massive unconsolidated salt water [illegible]

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
1800' sand	Pliocene	1790'	290'	Massive unconsolidated salt water sands having large
2400' sand	Pliocene	2360'	135'	regional distribution

D. Engineering description of injection units

1. Porosity: 34%
2. Permeability: Measurable in Darcy's
3. Original Reservoir Pressure: Logged with 9.7 lbs./gal. mud 0.465 (2360) = 1097
4. Reservoir Temperature: Less than 102°F
5. Chemical Character of Formation Water: Salt water or unknown composition and density.
6. Formation Fracture Pressure: 1662 psi

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Well Penetrated (		3000'	Massive porous sandstone	Not applicable
			fresh and brackish water sands	

F. Mineral Resources (oil and gas, coal, brines, etc.)

No commercial zones of oil, gas or coal have been penetrated by this well. However, numerous brackish and salt water sands were penetrated below 3000' to T.D.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade		Size	Depth Set	Type & Amount of Cement
Surface	17-1/2	47 lb.	J-55	13-3/8"	[illegible].50'	Common Class (H) 1775 sks
Intermediate.						
Injection		[illegible] lb.	J-55	9-5/8"	[illegible]	Set on packer
		[illegible] lb.	N-80	9-5/8"	[illegible]	Hung in tension
Other Conductor	30"		.344 wall	30'	30[illegible].55'	Driven

[illegible] bottom hole completion method: Injection of liquid waste through perforations in 11-3/4" casing from [illegible] to [illegible].

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Packer: Baker Model [illegible] 9-5/8" X 11-3/4"

Centralizers: No information available

Well Head: [illegible] psi test, Gray Tool Co., 11-3/4" OD X 9-5/8" OD X 2-3/8" OD [illegible] well head assembly, [illegible] psi W.P.

VI. Description of surface equipment

A. Holding tanks & flow lines Cool water is injected into this well to maintain a positive head on the well. No special tanks. Approximately 150' of 6" steel pipe.

B. Filters 1-9' diameter downflow sand filter

C. Pumps

D. Other An emergency injection system has been provided. In case of injection pump failure, a valve opens automatically and completed water is provided from a head tank which supplies approximately 80-90 lbs. pressure.

VII. Cores, samples, & Logs

A. Coring - No cores taken

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

X Drilling time

Sample Log

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity ___ Gamma ray-neutron

X SP ___ Temperature

___ Caliper ___ Cement bond

___ Other

VIII. Waste Characteristics

A. Industrial process from which waste is derived

The waste is derived from the manufacture of acrylonitrile.

B. Physical & chemical Description

This well serves as a standby for the [illegible] stripper bottoms stream going to the No. 2 well. Normally only [illegible] river water is injected in the No. 2 well. Coagulated river water has been clarified and settled and is injected here only to maintain a positive head on the well.

C. Volume Approximately [illegible] gallons per minute.

IX. Preinjection waste treatment [illegible] and filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
[illegible]	[illegible]	[illegible]	Recovered approximately 100 cu. [illegible] [illegible] unconsolidated sand and salt water.
Injection	24 hours	[illegible]	Injected 400 GPM fresh water with 70 psig surface pressure.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
No treatment or stimulation performed.		

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum
[illegible]	Average	50 GPM	Maximum	50 GPM
[illegible]	"	50 GPM	"	50 GPM
[illegible]	"	50 GPM	"	50 GPM
[illegible]	"	50 GPM	"	50 GPM
1970	"	50 GPM	"	50 GPM

2. Pressure (well head X bottom hole ______)

Date(s)		Average		Maximum
[illegible]	Average	40 psi	Maximum	40 psi
[illegible]	"	40 psi	"	40 psi
[illegible]	"	40 psi	"	40 psi
[illegible]	"	40 psi	"	40 psi
[illegible]	"	40 psi	"	60 psi

Well operation & operating history

D. Description of operating procedure: This well has operated intermittently since [illegible] [illegible] injecting [illegible] water at low volume and low pressure.

E. Operating problems: No operational problems other than normal [illegible].

8. Regulatory aspects.

A. Construction requirements:

B. Monitoring requirements: None other than pressure and volume.

C. Restrictions on operating procedure: None other than normal State permit requirements.

XII. Economics

A. Total & unit costs of construction [illegible]

B. Operating costs [illegible]/year (maintenance)

XIII. Source(s) of Information and Published References

[illegible] Water [illegible] Bulletin No. 1 and No. 2.

I. Operating Company & General Well Location

American Cyanamid Company disposal well No. 2 operated by American Cyanamid Company is located on their Fortier plantsite in Jefferson Parish, Louisiana.

II. Well location (legal description)

[illegible]' 6" from SE corner of Section 3, T13S, R22E on bearing N 23° - 29' W

Section 3, T13S, R22E, Jefferson Parish

III. History, system planning, construction & operation.

In 1964, American Cyanamid Company began planning a new acrylonitrile facility at our Fortier plant. The study indicated that technology was not available for a treatment facility for the cyanide waste which was generated by this new facility. It was determined that the only feasible disposal system was that of disposal by deep wells. Feasibility and compatibility studies were undertaken by a consulting engineer in 1965 for this deep well facility. Compatibility of the waste with the natural waters from the anticipated disposal zone indicated the project was feasible. Design was done by Walk-Haydel of New Orleans and the installation of the well was done under the direction of Cyanamid's Engineering and Construction Division and Walk-Haydel. This well has served as a primary disposal system for waste from the acrylonitrile process, methyl methacrylate waste acid and other miscellaneous streams. The operation has been relatively trouble free with a workover only being required once, which was in the first week of operation. The well was modified in early 1969 to accept acid and waste. The well required a workover in 1970 because of a mechanical failure of a coupling in the injection string.

IV. Geology & Geohydrology

A. Regional geologic setting:

The well is located in the southern margin of the Gulf Coastal Plain. The well penetrates a large regional anamoly associated with a southerly plunging syncline.

The stratigraphic section consists of massive Tertiary and Quaternary sands, clays, and shales.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes X ; no ___).

(Ground elevation 5.0') (Total well depth 3302)

Datum for depth measurement RKB to G.L.

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Undifferentiated	Recent	0	1000'	Alternating shale and massive fresh
	Pleistocene			water sand sequence
Undifferentiated	Pleistocene and Pliocene	1000'	1360'	Alternating shale and massive brackish and salt water sands
2400' sand	Pliocene	2365'	125'	Massive unconsolidated salt water san
2700' sand	Pliocene	2745'	65'	Massive unconsolidated salt water san
3000' sand	Pliocene	2980	290'	Massive unconsolidated salt water san

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
1800' sand	Pliocene	1790'	280'	Massive unconsolidated salt
2400' sand	Pliocene	2365'	125'	water sands having large
2700' sand	Pliocene	2745'	65'	regional distribution.
3000' sand	Pliocene	2980'	290'	

D. Engineering description of injection units

1. Porosity: 34%
2. Permeability: Measurable in Darcy's
3. Original Reservoir Pressure: Drilled with 9.7 lb. mud
   0.465 (2980) Log with 10.1
4. Reservoir Temperature: Less than 102°F
5. Chemical Character of Formation Water:
   (Salt water of unknown composition and density.)
6. Reservoir Fracture Pressure: 2086 psi

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Undifferentiated	0'	1000'	Massive recent pleistocene fresh and brackish water sands.	Not available

F. Mineral Resources (oil and gas, coal, brines, etc.)

No commercial zones of oil, gas or coal have been penetrated by this well. However, numerous brackish and salt water sands were penetrated below 1000' to T.D.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	17-1/2	47 lb. J55 Steel	11-3/4	3066.43'	Common + gel 1900 SKS
Intermed.					
Injection		32.3 lb/ft. J55 Steel	9-5/8"	2876.64'	Set on PKR
		.300 wall fibercast	5-1/2"	3008'	Hung in tension

[illegible] 20", 0.375" wall driven to 95.78

The bottom hole completion method: Injection of liquid waste through [illegible]tions in [illegible]-3/4" casing from 3085'-3000'.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Packer: Baker Model "C"-53-6813B 9-5/8" X 11-3/4"

Centralizers: spaced every 100' on 3-1/2" Fibercast tubing

Well head: 2175 psi test, Gray Tool Company, 11-3/4" OD X 9-5/8" OD X 3-1/2" OD, well head assembly: 1440 psi W.P.

VI. Description of surface equipment

A. Holding tanks & flow lines Tanks: 13,500 gallon plastic, 10,000 gallon plastic, 10,000 gallon steel. Piping: 1500 ft. 3" polypropylene lined steel pipe; 1200 ft. of 6" steel pipe.

B. Filters Four-9' diameter steel downflow sand filters, one-4' diameter rubber lined steel upflow filters, two-4' diameter plastic upflow filters. Two rubber lined steel polishing filters 18" in diameter with 20 micron socks.

C. Pumps Eight steel pumps, four alloy 20 pumps

D. Other

An emergency injection system has been provided. The system provided for the No. 1 well also services the No. 2 well. In addition, there is a natural gas engine driven pump which is started automatically in case of power failure or loss of pressure in the injection line.

VII. Cores, samples, & Logs No cores taken

A. Coring

From ______ to ______ Recovery ______

"
"
"
"
"

B. Drilling Logs

X Drillers Log X Drilling time

____ Sample log ____ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity — X Gamma ray-neutron

X SP — ___ Temperature

X Caliper — ___ Cement bond

___ Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Acrylonitrile, methyl methacrylate, melamine, hydrogen cyanide, yellow prussiate of soda. The waste is derived from the manufacture of acrylonitrile.

B. Physical & chemical Description Acrylonitrile plant wet stripper bottoms liquid, 200 ppm ammonia, 500 ppm sulfates and up to 100 ppm solids; waste water column bottoms liquid, about 1% suspended solids. Methyl methacrylate plant - liquid up to 30% sulfuric acid, up to 20% sulfates. Melamine plant - liquid, 800 ppm urea and about 500 ppm ammonia. The hydrogen cyanide plant - average 20 ppm HCN. Yellow prussiate of soda - liquid, 2% YPS, 100 ppm free cyanide.

C. Volume 200 GPM wet stripper bottoms, 50 GPM waste water column bottoms, 20 GPM methyl methacrylate waste acid, 70 GPM melamine, 5 GPM hydrogen cyanide, 20 GPM yellow prussiate of soda.

IX. Preinjection waste treatment Settling and filtration.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Backwash	90 hours	3170-3200'	Recovered ± 100 yds.³ coarse sand
			and salt water
Injection	24 hours	3170-3200'	300 GPM fresh water with 50 psig
			surface pressure
Injection	24 hours	3085-3200'	95 GPM fresh water with 22 psig
			surface pressure
Injection	24 hours	3085-3200'	150 GPM fresh water with 60 psig
			surface pressure

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
3000' SD	February 1969	Started injecting methyl methacrylate
		waste acid with approximately 100 psi
		surface pressure.

C. Injection rates and pressures

1. Rate (NSB)

Date(s)		Average		Maximum	
Date(s)	1966-1968	Average	250 GPM	Maximum	300 GPM
"	1966-1968	"	250 GPM	"	300 GPM
"	1966-1968	"	[illegible] GPM	"	300 GPM
"	1966-1968	"	[illegible] GPM	"	300 GPM
"	7/71, 8/71, 9/71	"	[illegible] GPM	"	320 GPM

2. Pressure (well head ___X___ bottom hole ______)

Date(s)		Average		Maximum	
Date(s)	1966-1968	Average	110 psi	Maximum	160 psi
"	1966-1968	"	110 psi	"	160 psi
"	1966-1968	"	110 psi	"	160 psi
"	1966-1968	"	110 psi	"	160 psi
"	7/71, 8/71, 9/71	"	105 psi	"	115 psi

X. Well operation & operating history

D. Description of operating programs: Well completed in January 1966. Injected net stripper bottoms from March 1966 until February 1969, at which time methyl methacrylate waste acid was started into the well and has been successfully injected to this date.

E. Operating problems: Limited to normal pump maintenance. One problem with sanding up during initial startup. One tubing coupling failure in May 1970.

XI. Regulatory aspects.

A. Construction requirements Designed to conform with Conservation Department requirements.

B. Monitoring requirements None required.

C. Restrictions on operating procedures None other than normal permit restrictions.

I. Economics

A. Total & unit costs of construction $600,000

B. Operating costs $60,000

I. Source(s) of Information and Published References

Louisiana Water Resources Bulletin No. 1 and No. 2.

WELL FILE NUMBER LA. STATE L-26 UMN

#1 Well

I. Operating Company & General Well Location

TEXACO INC.

Louisiana Plant Refinery (Near Union).

P. O. Box 37

Convent, Louisiana 70723

II. Well location (legal description)

S44° 43'10"W 4027.24' fr. NE/COR Sec 5, T11S, R3E

Lambert Coordinates - X-2,137,759.80, Y-525,531.54

III. History; system planning, construction & operation.

4-8-65 Installation of waste disposal well recommended by Mr. Robert A. LaFleur, Executive Secretary LA Stream Control Commission.

9-16-65 Permission obtained from La. Dept of Conservation to drill well.

8-1-66 Well acceptance injection test completed 600 GPM and 40 PSIG well head pressure.

IV. Geology & Geohydrology

A. Regional geologic setting: The disposal well is located along the extreme Northeast margin of the South La. Gulf Coast Salt Dome Basin.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes____; no X).

(Ground elevation________) (Total well depth 2200')

Datum for depth measurement Rotary Table

Name	Age	Depth (top)	Thickness	Lithologic Description
--	Pleistocene	*	*	Sand and Shale

* No data available as to exact top and bottom of Pleistocene

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
	Pleistocene	1990	100'±	Unknown(Over 100 Sq. Miles)
	Pleistocene	1880	100'±	Unknown(Over 100 Sq. Miles)

D. Engineering description of injection units

1. Porosity: Estimate 35%
2. Permeability: Estimate 1000-4000 Millidarcies or more
3. Original Reservoir Pressure: Calculate by Multiplying Depth by 0.467 2000Ft x 0.467 psi/ft. = 934psi
4. Reservoir Temperature: 116°F
5. Chemical Character of Formation Water: See Attachment #1
6. Reservoir Fracture Pressure:
   @ 2000' = 2000 x 0.667 = 1334 psi
   @ 2200' = 2200 x 0.675 = 1485 psi

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
--	±100'	±500'*	Sand	Unknown

*Indicated by Electric Log

F. Mineral Resources (oil and gas, coal, brines, etc.)

NONE

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	25"	Conductor Casing	20"	60'	Common 120sx
Intermed.	18"	Outer Casing-API5L Plain Steel 54.5#/ft J-55, ST&C	13 3/8"	1943'	Data not Availab!
Injection	12¼"	Inner String-CS 24#/ft, J-55, ST&C, Internally coated w/tube kote 90	8 5/8"	2065'	
Other					

Describe bottom hole completion method: Run under reamer and ream 9 7/8" Pilot hole to 24" hole through injection interval. Make up screen setting with blank riser pipe and run total depth. Place gravel in annulus. Run initial production test before setting packer to ensure gravel properly placed. Run packer on 8 5/8" tubing to top of blank liner, set down on liner to set packer per manufacturer's instructions.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Packer by Halliburton

Gulf Coast Machine & Supply Co. type GT Casinghead Assembly

Centralizers, float collar, float shoe (data not available as to type)

VI. Description of surface equipment

A. Holding tanks & flow lines 28.5'Ø x 32' - 2.5 Mbbl Tank

8" Ø fill and suction lines

2" Ø oil skim

(NOTE: Erection complete; will be put on line after testing)

B. Filters 250 gpm Hayward filter with sand, garnet, and coal media

(NOTE: Filter has been tested but is not on line yet).

C. Pumps 250 gpm filter feed (20 psi); 550 gpm injection (175psi); 550 gpm injection (175psi); 25gpm Pool Oil; 2 gph Algicide injection (not in use)

D. Other 2 - surge drums (7.5' Ø x 175') presently being used. will ultimately be used only when 2.5 Mbbl tank being cleaned.

VII. Cores, samples, & Logs

A. Coring not performed

From	to	Recovery

B. Drilling Logs

X Drillers Log ___ Drilling time

X Sample log (sieve anlaysis through injection zone) ___ Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

X Caliper

X Other Directional, Photosurvey

Gamma ray-neutron

Temperature

Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Petroleum Refining

B. Physical & chemical Description

Sulfidic (sour) and phenolic process waste water

C. Volume 100 GPM

IX. Preinjection waste treatment NONE

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
-1-66) Injection		Injection	600 GPM and 40 psig
-?-70) Injection	3 hrs	Injection	

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
?1-66) Injection	Acidize	2000 Gal 15% HCL
17-67) Injection	Acidize	
?2-68) Injection	Acidize	
?5-68) Injection	Contractor removed 20 ft. solids from well screen	
		Flow reestablished
?3-69) Injection	Acidize & clean out	Favorable Restoration

C. Injection rates and pressures

1. Rate

Date(s) Continuous opn. Average 100 GPM Maximum 600 GPM (test)

2. Pressure (well head ______ bottom hole X)

Date(s) Continuous Opn. Average 1150 psig Maximum 1495 psig (te[illegible]

X. Well operation & operating history

D. Description of operating programs: Continuous Operation

E. Operating problems: Reduced Performance - Improved performance expected after new settling tank and filter placed on stream.

XI. Regulatory aspects.

A. Construction requirements Drill 18" OD Hole to approximately 1900' and underream from 1790' to 1900' for gravel pack; csg. program - 13 3/8" set at 1800' and CMTD to surface; 8 5/8" prod string on packer to TD w/SLTD liner

B. Monitoring requirements Pressure (annulus and injection), flow

C. Restrictions on operating procedure

XII. Economics

A. Total & unit costs of construction $200,000 Total: $150,000 drill well; $50,000 pumps, piping, tank and vessels and filter.

B. Operating costs NA

XIII. Source(s) of Information and Published References

1. Deep Well Injection of Liquid Waste by D.L. Warner PHS Publ. No. 999 - WP-21, 1965.
2. Subsurface Salt-Water Disposal, API 1960.
3. Ground Water and Wells, Edward E. Johnson Inc. Publisher, 1966.
4. Subsurface Disposal of Industrial Wastes, published by Interstate Oil Compact Commission, Oklahoma City, Okla., 1968.
5. Ultimate Disposal of Advanced - Treatment Waste by Louis Koenig- Research, PHS Publ. No. 999-WP-10.
6. "Deep Well Waste Injection - Reaction With Aquifer Water" by D. L. Warner, "Journal of Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers", August 1966.

TEXACO INC.
Samples collected 5-13 & 14-69

LOUISIANA PLANT

ATTACHMENT #1

RESULTS OF WATER ANALYSES

FORMATION WATER COLLECTED
[illegible]

PROPERTY	WELL #1	WELL #2
Dissolved Oxygen		
Sulfide as H_2S	-0-	-0-
pH	6.6	7.0
Alkalinity as $CaCO_3$	18	24
Acidity as CO_2		
$CaCO_3$ stability index	-.6	-.6
Temperature, °F	90	90
Redox potential, Ec mv	+60	120
Reducing capacity as SO_3		
Iron	30	32
Calcium	5,100	5,250
Magnesium	1,350	1,400
Sodium	28,100	30,500
Barium	165	200
Sulfate	-0-	-0-
Carbonate	-0-	-0-
Bicarbonate	29	22
Chloride	56,400	60,600
Total dissolved solids	91,200	98,000
Specific gravity, 60/60	1.063	1.067
Turbidity as SiO_2	*	

*Considerable iron hydroxide precipitate

WELL FILE NUMBER LA. STATE L-27 UMR #2 WELL

I. Operating Company & General Well Location

TEXACO INC.

Louisiana Plant Refinery (near Union)

P. O. Box 37

Convent, Louisiana 70723

II. Well location (legal description)

S 40° 28' 40"W 3614.58' fr. NE/COR Sec 5, T11S, R3E

Lambert Coordinates - X-2,138, 247.03, Y-525,643.68

III. History, system planning, construction & operation.

4-8-65 Installation of waste disposal well recommended by Mr. Robert A. Lafleur, Executive Secretary La. Stream Control Commission

9-16-65 Permission obtained from La. Dept. of Conservation to drill well.

7-2-66 Well acceptance injection test completed 600 GPM and 83 psig well head pressure

IV. Geology & Geohydrology

A. Regional geologic setting: The Disposal Well is located along the extreme Northeast margin of the South La. Gulf Coast Salt Dome Basin.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no_x_).

(Ground elevation__________) (Total well depth 2200')

Datum for depth measurement Rotary Table

Name	Age	Depth (top)	Thickness	Lithologic Description
--	Pleistocene	*	*	Sand and Shale

*No data availabe as to exact top and bottom of Pleistocene

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
	Pleistocene	1990	100'±	Unknown(over 100 Sq. Miles)
	Pleistocene	1850	100'±	Unknown(over 100 Sq. Miles)

D. Engineering description of injection units

1. Porosity: Estimate 35%
2. Permeability: Estimated 1000-4000 Millidarcies or more
3. Original Reservoir Pressure: Calculate by Multiplying Depth by 0.467 2000ft. x 0.467 psi/ft = 934 psi
4. Reservoir Temperature: 116°F
5. Chemical Character of Formation Water: See Attachment #1
6. Reservoir Fracture Pressure:
   @2000' = 2000 x 0.667 = 1334 psi
   @2200' = 2200 x 0.675 = 1485 psi

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
--	± 100'	±500'*	Sand	Unknown

* Indicated by Electric Log

F. Mineral Resources (oil and gas, coal, brines, etc.)

NONE

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	25"	Conductor Casing	20"	41'	Redimix 80 Sx
Intermed.	18"	Outer Casing ApI5L Plain Steel 54.5#/ft J-55, ST&C	13 3/8"	2198	Posmix 1400 Sx Common 150Sx + 115Sx
Injection	Inner String - CS 8 5/8" 24#/ft, J-55 Grade, ST&C, Internally Coated w/Tube kote 90				
Other					

Describe bottom hole completion method: Run under reamer and ream 9 7/8" pilot hole to 24" hole through injection interval. Make up screen setting with blank riser pipe and run total depth. Place gravel in annulus. Run initial Production Test before setting packer to ensure gravel properly placed. Run packer on 8 5/8" tubing to top of blank liner, set down on liner to set packer per manufacturer' instructions.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Packer by Halliburton

Gulf Coast Machine & Supply Co. type CY casinghead assembly.

Centralizers, float shoe, float collar (Data not available as to type)

VI. Description of surface equipment

A. Holding tanks & flow lines 2.5 Mbbl Settling Tank; 8"Ø fill and suction lines; 2" Ø oil skim

(NOTE: Erection complete; tank to be placed on line after necessary tests)

B. Filters 250 GPM Hayward filter with sand, Durcon, and coal midia.

(NOTE: Filter has been tested but it is not on line yet)

C. Pumps 250 GPM Filter Feed (20 psi); 550 gpm injection (175psi); 550 gpm injection (175psi); 25 gpm Foul Oil; 2gph Alkycide Injection (Not in use)

D. Other 2 Surge Drums (7.5' Ø x 17.5) presently in use; will ultimately be used only when 2.5 Mbbl tank being cleaned.

VII. Cores, samples, & Logs

A. Coring Not Performed

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

X Sample log (Sieve Analysis through injection zone)

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

_X_ SP

____Caliper

____Other____________________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Petroleum Refining

B. Physical & chemical Description

Sulfidic (sour) and phenolic Process waste water.

C. Volume 100 GPM

IX. Preinjection waste treatment NONE

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
?2-66) Injection		Injection	600GPM and 82 PSIG
.-70) Injection		Injection	

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1-67) Injection	Acidize	2000 Gal 15% HCL
7-67) Injection	Acidize	
-68) Injection	Acidize	
5-68) Injection	Contractor Removed 67 ft. solids from well screen and acidize - Injection proceeded	
2-69) Injection	Acidize & Wire Gauged - 40 ft. solids in injection sc	
4-70) Injection	Acidize & Clean out	Favorable Restoration

C. Injection rates and pressures

1. Rate

Date(s) Continuous Opn. Average 100GPM Maximum 600GPM (test)

2. Pressure (well head ______ bottom hole X)

Date(s) Continuous Opn. Average 1300PSIG Maximum 1544 PSIG (test

X. Well operation & operating history

D. Description of operating programs: Continuous Operation

E. Operating problems: Reduced Performance - Improved performance expected after new settling tank and filter placed on stream.

XI. Regulatory aspects.

A. Construction requirements Drill 18" OD hole to approximately 1900' and underream from 1790'-1900' for gravel pack; csg. program - 13 3/8" set at 1800' and CMTD to surface; 8 5/8" PROD string on packer to TD w/SLTD Liner.

B. Monitoring requirements Pressure (annulus and injection) flow

C. Restrictions on operating procedure

XII. Economics

A. Total & unit costs of construction $200,000 Total: $150,000 drill well; $50,000 pumps, piping, tank, vessels, and Filter

B. Operating costs

N/A

XIII. Source(s) of Information and Published References

1. Deep Well Injection of Liquid Waste by D. L. Warner PHS Publ. No. 999-WP-21, 1965.
2. Subsurface Salt-Water Disposal, API 1960.
3. Ground Water and Wells, Edward E. Johnson Inc. Publisher 1966.
4. Subsurface Disposal of Industrial Wastes, Published by Interstate Oil Compact Commission, Oklahoma City, Okla. 1968
5. Ultimate Disposal of Advanced-Treatment Waste by Louis Koenig-Research, PHS Publ. No. 999-WP-10.
6. "Deep Well Waste Injection - Reaction with Aquifier Water" By D. L. Warner, "Journal of Sanitary Engineering Division Proceedings of the American Society of Civil Engineers," August, 1966.

TEXACO INC.
Samples collected 5-13 & 14-69

LOUISIANA PLANT

ATTACHMENT #1

RESULTS OF WATER ANALYSES

FORMATION WATER COLLECTED WHEN WELLS WERE DRILLED

PROPERTY	WELL #1	WELL #2
Dissolved Oxygen		
Sulfide as H_2S	-0-	-0-
pH	6.8	7.0
Alkalinity as $CaCO_3$	18	24
Acidity as CO_2		
$CaCO_3$ stability index	-.6	-.6
Temperature, ^{o}F	90	90
Redox potential, Ec mv	+60	120
Reducing capacity as SO_3		
Iron	38	32
Calcium	5,100	5,250
Magnesium	1,340	1,400
Sodium	28,100	30,500
Barium	165	200
Sulfate	-0-	-0-
Carbonate	-0-	-0-
Bicarbonate	29	22
Chloride	56,400	60,600
Total dissolved solids	91,200	98,000
Specific gravity, 60/60	1.063	1.067
Turbidity as SiO_2	*	

*Considerable iron hydroxide precipitate

WELL FILE NUMBER LA. STATE L-28 UMR #3 WELL

I. Operating Company & General Well Location

TEXACO INC.

Louisiana Plant Refinery (near Union)

P. O. Box 37

Convent, Louisiana 70723

II. Well location (legal description)

Lambert Coordinates X-2, 135, 498.93 Y-524, 507.23

Sec 12, T115, R3E

III. History; system planning, construction & operation.

4-3-70 Permission obtained from La. Geological Society to Drill #3 Well.

4-6-70 Permission (Work Permit obtained from La. Dept. of Conservation to drill well

IV. Geology & Geohydrology

A. Regional geologic setting: The Disposal Well is located Along the extreme Northeast margin of the South La. Gulf Coast Salt Dome Basin

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no x).

(Ground elevation________) (Total well depth 2200')

Datum for depth measurement Rotary Table

Name	Age	Depth (top)	Thick-ness	Lithologic Description
--	Pleistocene	*	*	Sand and Shale

*No data available as to exact top and bottom of Pleistocene

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
	Pleistocene	1990'	100'±	Unknown (Over 100 Sq. Miles)
	Pleistocene	1850'	100'±	Unknown (Over 100 Sq. Miles)

D. Engineering description of injection units

1. Porosity: Estimate 35%
2. Permeability: Estimate 1000- 4000 Millidarcies or More
3. Original Reservoir Pressure: Calculate by Multiplying Depth by 0.467 2000 ft. x 0.467 psi/ft = 934 psi
4. Reservoir Temperature: 116°F
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:
@ 2000' = 2000 x 0.667 - 1334 psi
@ 2200' = 2200 x 0.675 = 1485 psi

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
	±100'	±500'*	Sand	Unknown

*Indicated By Electric Log

F. Mineral Resources (oil and gas, coal, brines, etc.)

NONE

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	30"	Conductor 196#/ft.	30"	73'	Data not available
Intermed.	26"	Casing - 65#/ft	16"	1000'	Common 2375 Sacks
	14 3/4"	Casing - 40.5#/ft K-55	10 3/4"	1993'	[illegible]
Injection		Inner String	7"	2105'	
		Internally coated with Tubekote TK21			
Other		Airlift tubing 2 3/8" 873'			

Describe bottom hole completion method: Underream hole to 26" Through disposal sand. Run 7" Monel Pipe type wire wrapped gravel pack screen through underreamed section of hole. Place gravel around screen. Run 7" packer and 7" tubing to top of blank lines. Set packer per manufacturer's instructions. Swab well through 7" tubing until maximum deliverability is achieved.

V. Well design and construction, continued 3.

B. Packers, Centralizers, well head equipment, etc: ________

Texas iron works rubber pin packer

Float shoe, float collar - Baker and Dowell; Centralizer-

type unknown

Brewster well head

VI. Description of surface equipment

A. Holding tanks & flow lines 54.4 Mbbl

Ballast Tank with 20" Ø fill and 8" Ø swing and suction lines.

2.5 Mbbl Backwash tank with 6" fill and 4" suction lines.

B. Filters 600 gpm filter proposed. Type filter to be

determined from analysis of injection water.

C. Pumps 600 gpm filter feed

600 gpm (600 psi) well injection, 450 gpm oil skim.

D. Other ________

VII. Cores, samples, & Logs

A. Coring not performed

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

___ Sample log

___ Drilling time

___ Other: ________

VII. -- Cores, samples, & logs, continued

C. Other logs run

_X_ Resistivity

_X_ SP

___ Caliper

___ Other ______

___ Gamma ray-neutron

___ Temperature

___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Petroleum Refining

B. Physical & chemical Description

Chlorides, Sulfides

C. Volume to be determined (Estimate 450 GPM)

IX. Preinjection waste treatment NONE

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection (8-13-70)	2 hrs	Injection	Max Press 600 psi
			Max Flow 600 gpm
			Fresh Water Test

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures-only injection test

1. Rate

Date(s)________ Average______ Maximum______
" ________ " ______ " ______
" ________ " ______ " ______
" ________ " ______ " ______
" ________ " ______ " ______

2. Pressure (well head ________ bottom hole______)

Date(s)________ Average______ Maximum______
" ________ " ______ " ______
" ________ " ______ " ______
" ________ " ______ " ______
" ________ " ______ " ______

X. Well operation & operating history- well not in operation yet

D. Description of operating programs: N/A

E. Operating problems: N/A

XI. Regulatory aspects.

A. Construction requirements 24" csg. set at 50', 16" csg. at 900' and CMT to surface, 10 3/4" csg. set at 2100' and CMT to surface. Injection string will be 7" csg. with packer immediately above the 2100' level. A 2½" tbg. will be utilized for backwashing. Minimum standard for casings as follows: 15" 75#; 10 3/4": 40.5#; 7": 23#

B. Monitoring requirements Pressure, Annulus and Injection flow

C. Restrictions on operating procedure

XII. Economics

A. Total & unit costs of construction $300,000 Total: $150,000 drill well; $150,000 ballast and backwash tanks, pumps, piping, treatment facilities.

B. Operating costs

XIII. Source(s) of Information and Published References

1. Deep Well Injection of Liquid Waste by D. L. Warner PHS Publ. No. 999 -WP-21, 1965.
2. Subsurface Salt-Water Disposal, API 1960.
3. Ground Water and Wells, Edward E. Johnson Inc. Publisher, 1966.
4. Subsurface Disposal of Industrial Wastes, Published by Interstate Oil Compact Commission, Oklahoma City, Okla. 1968
5. Ultimate Disposal of Advanced - Treatment Waste by Louis Koenig- Research PHS Publ. No. 999-WP-10.
6. "Deep Well Waste Injection-Reaction with Aquifer Water" By D. L. Warner, "Journal of Sanitary Engineering Division, Proceedings of the American Society of Civil Engineers," August 1966.

WELL FILE NUMBER

STATE L-29

UMR

I. Operating Company & General Well Location

Shell Chemical Company Geismar Louisiana

Aqueous Waste Disposal Well #2

II. Well location (legal description)

Begin NW cor Lot 1, Sec. 14 T10S. R2E th. N 55° 35' 59"E along prop. line 3,452.6' th. N55° 56' 03"E 735.05 th. S34°24' 01"E 274.4' to well

III. History, system planning, construction & operation.

The well was drilled to provide a means of disposal for plant aqueous wastes. The surface facilities were designed by Shell Chemical and installed by Foster Wheeler Corp. The subsurface facilities were designed by Shell Oil and installed by Stamm-Scheele under Shell Oil's supervision. The well was originally drilled as an acid disposal well, but the casing was broken during construction. The broken casing was drilled out, and the well was completed as an aqueous disposal well. The well was commissioned in the 2nd quarter of 1967 and has been in continuous service since.

IV. Geology & Geohydrology

A. Regional geologic setting: Geismar is located within the Mississippi Embayment on the deltaic plain of the Mississippi River. The upper 4100 feet of sediments penetrated to date by drilling in the immediate vicinity are Quaternary and Tertiary sands, shales and clays.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no_X_).

(Ground elevation 20 approx.) (Total well depth 1700)

Datum for depth measurement 2.7' above CHF

Name	Age	Depth (top)	Thickness	Lithologic Description
Unnamed	Quaternary	Surface	1700	Sand, clay, and shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Unnamed	Quaternary	1285	65	Unknown
Unnamed	Quaternary	1356	70	Unknown

D. Engineering description of injection units

1. Porosity: 33%
2. Permeability: 3D
3. Original Reservoir Pressure: 800 psi
4. Reservoir Temperature: 90° F
5. Chemical Character of Formation Water: 25,000-50,000 ppm cl-
6. Reservoir Fracture Pressure: 1105 psi

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

None below surface casing

F. Mineral Resources (oil and gas, coal, brines, etc.)

None.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	9 7/8"	23#	J-55	7"	1012'	Class A 500 sacks
Intermed.	6 1/4"	17#	N-80	5 1/2"	1698'	Common 100 sacks
Injection	6 1/4"	2.4#	J-55	1 1/4"	1496'	

Other

Describe bottom hole completion method: Float Collar 1654' ; Set shoe at 1698.

V. Well design and construction, continued 4.

B. Packers, Centralizers, well head equipment, etc: ______

Packer: 5 1/2 X 3 1/2" [illegible] at 1502

Flow line coupling - 3 1/2" screen from 1502-1529

VI. Description of surface equipment

A. Holding tanks & flow lines ______

Tank: 135,000 Gallon Steel

Lines: 4" Carbon Steel to well.

B. Filters None.

C. Pumps [illegible]

D. Other ______

VII. Cores, samples, & Logs

A. Coring

From None ______ to ______ Recovery ______

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity — Gamma ray-neutron

X SP — Temperature

Caliper — Cement bond

Other

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Plantwide wastewater collection system.

B. Physical & chemical Description Water containing about [illegible] dissolved organic compounds; little or no solids.

C. Volume 800 bbl/day average; [illegible] bbl/day maximum

IX. Preinjection Waste Treatment Screened through 100 micron strainer. When solids are present, a precoat filter is used to remove solids.

[illegible]. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	1/2 hr.	15[illegible]0-1610	Took fluid at 1 BPM on vacuum

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) 1/68 to 7/71 Average [illegible]45 bbl/day Maximum 65[illegible]0 bbl/day

2. Pressure (well head ____ bottom hole ____)

Date(s) 1/68 to 7/71 Average 200 psig. Maximum 200 psig.

X. Well operation & operating history

D. Description of operating programs: The well is currently operated to keep a high flowrate at all times. When process water is not being pumped, clarified water is injected at the well head at ~70 psig.

E. Operating problems: The original well screen was removed in June 1971 because of plugging. Occasional backflush is now required.

XI. Regulatory aspects.

A. Construction requirements Approval of La. Geological Survey and State Board of Health.

B. Monitoring requirements None.

C. Restrictions on operating procedure None.

XII. Economics

A. Total & unit costs of construction $50,000

B. Operating costs $15,000/year

III. Source(s) of Information and Published References

WELL FILE NUMBER

1-30

STATE | UWR

I. Operating Company & General Well Location

Shell Chemical Company - Geismar, Louisiana

Aqueous Hydrochloric Acid Disposal Well #3

II. Well location (legal description)

Begin NW/C Lot 1 sec. 14, T 10 S, R2E th. N 55° 35' 59" E along prop. line 3452.6' th. N 55° 56' 03" E 805.05' th. S 34° 26' 01" E 234.49' to well.

III. History, system planning, construction & operation.

The well was installed to provide an alternate means of disposal for acid waste in the event of problems with Well #1. The surface facilities, which are common to wells #1 and 3, were designed and installed by Shell Chemical Company. The subsurface facilities were designed by Shell Oil Company and installed by Subsurface Disposal Corporation under Shell Oil's supervision. The well was commissioned in June, 1971 and has operated intermittently to date.

IV. Geology & Geohydrology

A. Regional geologic setting: Geismar is located within the Mississippi Embayment on the deltaic plain of the Mississippi River. The upper 4100 feet of sediments penetrated to date by drilling in the immediate vicinity are Quaternary and Tertiary sands, shales and clays.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no_x_).

(Ground elevation 20' approx) (Total well depth 2515)

Datum for depth measurement 3.0' above CHF

Name	Age	Depth (top)	Thickness	Lithologic Description
Unnamed	Quaternary	Surface	1980±	Clay, Shale, Sand
Unnamed	Pliocene	1980±	535	Clay, Shale Sand

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Unnamed	Quaternary	1790	30	Unknown
Unnamed	Quaternary	1930	20	"
Unnamed	Pliocene	1986	14	"
Unnamed	Pliocene	2236	70	"

D. Engineering description of injection units

1. Porosity: 33%
2. Permeability: 2 D
3. Original Reservoir Pressure: 1150'
4. Reservoir Temperature: 95°F
5. Chemical Character of Formation Water:
   25,000-50,000 ppm cl-
6. Reservoir Fracture Pressure: 1630 psi

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
None below surface casing.				

F. Mineral Resources (oil and gas, coal, brines, etc.)

None.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	15"	32.5#, H-40	10 3/4"	128	Class A; 500 sacks
Intermed.	9 7/8"	20#, J-55	7"	2323	Common; 350 sacks
Injection	6 1/4"	Fibercast	3 1/2"	2560	Lite wate; 210 sacks

Other

Describe bottom hole completion method: Float collar at 2475'. Halliburton shoe guide at 2506'.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ________

Flow line coupling

VI. Description of surface equipment

A. Holding tanks & flow lines 2 - 16,000 Gallon Owens-Corning Fiberglass tanks with 3" FRP piping to well head.

B. Filters None.

C. Pumps Solid Teflon 100 gpm, 30 psi Teflon pump.

D. Other None.

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
None		
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: ________

VII. -- Cores, samples, & logs, continued

C. Other logs run

_X_ Resistivity

_X_ SP

____ Caliper

____ Other ____

____ Gamma ray-neutron

____ Temperature

____ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chlorination of paraffins.

B. Physical & chemical Description 32% aqueous HCl.

C. Volume 2,000 bbls/day maximum

IX. Preinjection waste treatment Three stages of phase separation.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	1/4 hr.	2396-2400	Took fluid at 1 BPM on vacuum
Injection	1/4 hr.	2382-2386	Took fluid at 2 BPM on vacuum

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
2382-2386	EPOSAND 9	Acidize & Consolidate
2396-2400	EPOSAND 9	Acidize & Consolidate

C. Injection rates and pressures

1. Rate

Date(s) 7/1/71 to 8/1/71 Average 520 bbls/day Maximum 2000 bbls/day

" Average " Maximum "

2.* Pressure (well head 0 - 30 psig bottom hole)

Date(s) Average Maximum

*Flow is usually by gravity.

X. Well operation & operating history

D. Description of operating programs: Under normal conditions, acid in gravity flowed down the well without pumping.

E. Operating problems: None so far.

XI. Regulatory aspects.

A. Construction requirements approval of well design by the La. Geological Survey and the La. State Board of Health.

B. Monitoring requirements None.

C. Restrictions on operating procedure None.

XII. Economics

A. Total & unit costs of construction $161,000

B. Operating costs $10,000/year

XIII. Source(s) of Information and Published References

WELL FILE NUMBER

STATE　　　　　　L-31
UMR

I. Operating Company & General Well Location

Shell Chemical Company　Geismar, Louisiana

Aqueous Hydrochloric Acid Disposal Well #1

II. Well location (legal description)

Begin NW/C, lot 1, Sec. 14, T10S, R2E, th. N55° 35' 59"E along prop. line 3432.6'. th. N 55° 56' 03" E 735.05' th. S 34° 24' 01" E 263.87 to well.

III. History, system planning, construction & operation.

The well was installed to provide a means of disposal for waste 32% w Hydrochloric Acid from one of our process units. The present surface facilities, which are common to Wells #1 and #3, were designed and installed by Shell Chemical Company. The subsurface facilities were designed by Shell Oil Company and installed by Stamm-Scheele under Shell Oil's supervision. The well was commissioned in the fourth quarter of 1967 and has been in continuous operation since.

IV. Geology & Geohydrology

A. Regional geologic setting: Geismar is located within the Mississippi Embayment on the deltaic plain of the Mississippi River. The upper 4100 feet of sediments penetrated to date by drilling in the immediate vicinity are Quaternary and Tertiary sands, shales and clays.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 20' approx.) (Total well depth 4100)

Datum for depth measurement 13.6' above CHF

Name	Age	Depth (top)	Thickness	Lithologic Description
Unnamed	Quaternary	Surface	1980 +	Sand, clay, shale.
Unnamed	Tertiary	1980+	2120	"

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Unnamed	Pliocene	3550	60'	Unknown

D. Engineering description of injection units

1. Porosity: 33%
2. Permeability: 2 D
3. Original Reservoir Pressure: 1760 psi
4. Reservoir Temperature: 110°
5. Chemical Character of Formation Water: 25,000-50,000 ppm cl-
6. Reservoir Fracture Pressure: 2650 psi

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

None below surface casing.

F. Mineral Resources (oil and gas, coal, brines, etc.)

None.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	15"	32.75#, H-40	10 3/4"	740'	Class A, 500 sacks
Intermed.	9 7/8"	24#, H-40	7 5/8"	2973'	Class A, 590 sacks
Injection	6 1/4"	Fiberglas	4 1/2"	4063'	Lite water, 415 sacks

Other

Describe bottom hole completion method:

Float collar at 4066 w/5' cement: Float shoe at 4100.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ______

~~Surface Flow Line~~

VI. Description of surface equipment

A. Holding tanks & flow lines 2 - 16,000 gal Owens-Corning Fiberglass tanks with 3" Fiberglass piping to well head.

B. Filters None.

C. Pumps Solid Teflon 100 gpm, 30 psi. Centrifugal pump.

D. Other ______

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
None		

B. Drilling Logs

___ Drillers Log ___ Drilling time

___ Sample log ___ Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

____ Caliper

____ Other FDC, GR

____ Gamma ray-neutron

____ Temperature

____ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chlorination of paraffins.

B. Physical & chemical Description 32% w aqueous HCl.

C. Volume 2000 bbls/day maximum.

IX. Preinjection waste treatment Three stages of phase separation.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	1/2 day	4048-4058	Failed to take fluid.
Injection	1/2 day	3802-3807	Took fluid at 1 1/4 BPM on vacuum

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
4048-4058	EPOSAND 112	Squeezed Zone W/Cement.
3802-3807	EPOSAND 112	Sand Consolidated.

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Date(s)	1/68 to 7/70	Average	776 bbls/day	Maximum	2,000 bbls/day
"	7/70 to 7/71	"	518 "	"	2,000 "
"		"		"	
"		"		"	
"		"		"	

2.* Pressure (well head 0 - 30 psig bottom hole ______)

Date(s)		Average		Maximum	
Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

*Flow is usually by gravity.

X. Well operation & operating history

D. Description of operating programs: Under normal conditions, acid is gravity flowed down the well without pumping.

E. Operating problems: Occasional plugging requiring backflushing. The well has made sand on backflushing on several occasions within the past year.

XI. Regulatory aspects.

A. Construction requirements approval of well design by the La. Geological Survey and La. State Board of Health.

B. Monitoring requirements None.

C. Restrictions on operating procedure None.

XII. Economics

A. Total & unit costs of construction $110,000

B. Operating costs $13,000 per year

XIII. Source(s) of Information and Published References

WELL FILE NUMBER STATE L-32 UMR

I. Operating Company & General Well Location

Sun Oil Company Delhi Field, Richland Parish located at Delhi Gas Plant.

JUN 2 ? 1971

II. Well location (legal description)

Section 15, T17N, R9E, Delhi Field, Richland Parish, Louisiana. ...OLOGICAL SURVEY

III. History; system planning, construction & operation.

Completed 6-06-55 Perfs 3172-78' Gas well 5 Hrs 3/16" chk TP 870#
154 MCF - Nicholson Gas Unit No. 3.

WO #1 2-17-58: Sqzd orig perfs New perfs 3210-20'. Before WO: 169 MCFD, 169 BSWPD. After: 707 MCFD, 0 BSW, TO 930#.

WO #2 3-24-63: Conversion to propane storage well. Sqzd pres perfs New perfs 3171-73; 73-75; both sets of perfs acidized. Inj propane @ 7 BPM, 480#, unsuccessful recovery. Well shut in.

WO #3 12-21-68: Conversion to SWD well for cooling tower waste wtr from Delhi Gas Plant. Sqzd pres perfs New perfs 1220-75' (Sparta Sand). Disposed 823 BWPD on vacuum

Currently: 2-3/8" tbg w/btm OE, TS 1159', w/compression pkr @ 1156'; Gas Lift Valve @ 997'. Disposing 16,000 BWPM on 22" HG vacuum

IV. Geology & Geohydrology

A. Regional geologic setting: Normal regional dip to coast (Gulf).

The well is in the Mississippi River structural trough of the Gulf Coastal Plain. The region dip at the well site is toward the east. The stratigraphic sequence consists primarily of sands, clays, and gravels of Cretaceous and Tertiary ages.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no__x__).

(Ground elevation 90.5') (Total well depth 3246')

Datum for depth measurement RDB Elevation 101.5'

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Sparta	Tertiary	756'	650'	Sand
Wilcox	Tertiary	1765	885	Sand
Clayton	Tertiary	3150'	16'	Marl
Monroe Gas Rock	Tertiary	3169'	4'	Lime
Nicholson Gas Sand	Low. Cret.	3174'	15	Sand
Paluxy	Low. Cret.	3210'	28'	Sand

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Sparta Sand	Tertiary	756'	650'	Sand - Large Area

D. Engineering description of injection units

1. Porosity: 30% (est.)
2. Permeability: 500± Millidarcies Average (est.)
3. Original Reservoir Pressure: 400 psi (est.) From overburden pressure gradient.
4. Reservoir Temperature: 90° F. (est.) From geothermal gradient.
5. Chemical Character of Formation Water: From analysis of water after 5500 bbl backwash of disposal well.

   9,380 ppm chloride

   16,350 ppm total constituents
6. Reservoir Fracture Pressure: 400 psi (est.) From overburden pressure gradient.

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Cockfield	500±	500±	Sand	Fresh water to slightly brackish

F. Mineral Resources (oil and gas, coal, brines, etc.)

Original resource - gas from Nicholson Gas Sand & Paluxy Sand.

Cumulative Production - Nicholson Gas Unit No. 3

Nicholson Sand	-	226,134 MCF
Paluxy Sand	-	539,784 MCF
Total		765,918 MCF

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	13-1/4"	H-40 32#	9-5/8"	519'	300 sks Common w/4% gel.
Intermed.					
(Production)	7-7/8"	H-40 & J-55 14#	5-1/2"	3245'	200 sks w/4% gel
Injection		EUE J-55 4.7#	2-3/8"	1159'	

Other Gas Lift Mandrel @ 997' & seating nipple @ 1155'.

Describe bottom hole completion method: Cased hole. Perfs 1220-75' w/1 BSF.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Guiberson "Shorty" Packer @ 1156'. National Type "B" Series 900 Christmas Tree.

VI. Description of surface equipment

A. Holding tanks & flow lines 4 inch flowline.

B. Filters FECO Insert Filter

C. Pumps Centrifugal pump used to pump backwash water from pit.

D. Other Pit used for backwash water.

VII. Cores, samples, & Logs

A. Coring (Sidewall)

From 3191½ to 3236 Recovery 9 cores

B. Drilling Logs

X Drillers Log

___ Sample log

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

x Resistivity

x SP

x Caliper

___ Other Microlog, Casing Collar

x Gamma ray-neutron

___ Temperature

___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Cooling tower blowdown water and backwash water from Delhi Unit Gas Plant.

B. Physical & chemical Description Slightly saline water, 3500 ppm chlorides, pH - 6.8

C. Volume Averages 16,000 bbls water per month injected.

IX. Preinjection waste treatment Backwash water is pumped through filter before entering well. Blowdown water goes through sidestream filter before entering well.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
1. Gas Well	24 Hrs	Nicholson Gas Sand	In 5 hrs 154 MCF Gas
2. Gas Well	24 Hrs	Paluxy	707 MCFPD
3, Propane Storage Well		Nicholson Gas Sand	
4. Salt Water Disposal Well	24 Hrs	Sparta	Injected 823 BWPD on Vacuum

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1. Nicholson Gas Sand	500 Gal Dowell BDA	To increase injectivity for Propane storage - unsuccessful.
2. Nicholson Gas Sand	500 Gal HOWCO 15% HCl Acid	

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
12-21-68	823 BWPD	823 BWPD
7-23-69	864 BWPD	1728 BWPD
"	(on vacuum)	(35 psi inj press)
"		
"		

2. Pressure (well head Vacuum bottom hole None)

Date(s)	Average	Maximum
"		
"		
"		
"		

X. Well operation & operating history

D. Description of operating programs: Cooling tower blowdown water goes directly to well. Backwash water is pumped from pit (after time allowed for settling) into filter and then to well. Blowdown water is also filtered by sidestream filter before entering well.

E. Operating problems: Well presents no operating problems. Has been cleaned (backwashed) two times since disposal was started.

XI. Regulatory aspects.

A. Construction requirements Department of Conservation Well History & Work Resume Report; State of Louisiana Work Permit; SWD Well Application Approval.

B. Monitoring requirements Well monitored for monthly injection totals by Delhi Gas Plant personnel.

C. Restrictions on operating procedure

XII. Economics

A. Total & unit costs of construction

To Drill Well - $23,561 Expense, $9,220 Investment

Total of Workovers previous to SWD Conversion - $10,000.

Cost of SWD Conversion - $ 5,360

B. Operating costs

Labor	$ 80
80 Cartridges/Month for Filter	$ 100
Total Operating Costs/Mo.	$ 180

XIII. Source(s) of Information and Published References

Well File - Nicholson Waste Disposal Well No. 3

WELL FILE NUMBER STATE L-33 UMR

I. Operating Company & General Well Location

Dow Chemical Company

Plaquemines, Louisiana

II. Well location (legal description)

Location: Sec. 8, T9S, R12E, Iberville Parish, Louisiana.

III. History, system planning, construction & operation.

Injection commenced May 15, 1969. The well has since been abandoned and plugged.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the southern margin of the Gulf Coastal Plain. The stratigraphic section consists of alternating sands and shales of Tertiary and Quaternary age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).

(Ground elevation ________) (Total well depth 4200 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
	Miocene	3900ft.		sand

D. Engineering description of injection units

1. Porosity: ________
2. Permeability: ________
3. Original Reservoir Pressure: ________
4. Reservoir Temperature: ________
5. Chemical Character of Formation Water: ________
6. Reservoir Fracture Pressure: ________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
undifferentiated	0ft.	1000ft.	Pleistocene sands & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other ______________________________

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical plant waste

B. Physical & chemical Description Sodium chloride solution

C. Volume ______________________________

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) ______ Average ______ Maximum ______
" ______ " ______ " ______
" ______ " ______ " ______
" ______ " ______ " ______
" ______ " ______ " ______

2. Pressure (well head ______ bottom hole ______)

Date(s) ______ Average ______ Maximum ______
" ______ " ______ " ______
" ______ " ______ " ______
" ______ " ______ " ______
" ______ " ______ " ______

X. Well operation & operating history

D. Description of operating programs: ______________________

E. Operating problems: ______________________

XI. Regulatory aspects.

A. Construction requirements ______________________

B. Monitoring requirements ______________________

C. Restrictions on operating procedure ______________________

XII. Economics

A. Total and unit costs of construction ______

B. Operating costs ______

XIII. Source(s) of Information and Published References ______

I. O. C. C. - supplement

WELL FILE NUMBER | LOUISIANA STATE | L-34 UMR

I. Operating Company & General Well Location

CIBA-GEIGY Corporation

Iberville Parish

St. Gabriel, Louisiana

II. Well location (legal description)

525 feet north at an angle of 90 degrees from a point measured eastward 485 feet from the center line of River Road along the line dividing Sections 32 and 33 in Iberville Parish, Louisiana

III. History; system planning, construction & operation.

3-19-68 Feasibility Study Completed

7-29-70 Spudded Disposal Well No. 1

10-15-70 Completed Disposal Well No. 1

10-25-70 Initial Injection Began

12-19-70 Well Plugged and Workover Performed (12-19-70 to 4-17-71)

4-18-71 Resumed Injection

6-24-71 Well Plugged

IV. Geology & Geohydrology

A. Regional geologic setting: Located along the axis of the Mississippi structural trough of the Gulf Coast geosyncline.

The well is structurally located along the axis of the Mississippi trough of the coastal plain. The stratigraphic section consists primarily of sands, clays, and shales of Miocene, Pliocene, and Pleistocene ages.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no X).

(Ground elevation________) (Total well depth 6002)

Datum for depth measurement K.B. (Top of 3" Flg. to K.B. = 7.15')

Name	Age	Depth (top)	Thickness	Lithologic Description
Alluvium	Quaternary	0	600	Sand and gravel
	Pliocene	600	5200	Sand and shale
	Miocene	5000	6002	Sand and shale

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
3500 foot Sand #1	Pliocene	3600'	100'	At least 13 mi E-W by 8 mi N-S
4150 foot Sand #1	Pliocene	4150'	120'	At least 6 mi E-W by 3 mi N-S
4350 foot Sand #1	Pliocene	4350'	60'	At least 6 mi E-W by 3 mi N-S
4800 foot Sand #1	Pliocene	4750'	70'	Not definite E-W by 3 mi N-S
* 5300 foot Sand #2	Miocene	5550'	125'	At least 3 mi E-W by not def. N-S

* Present disposal zone

D. Engineering description of injection units (5300-foot Sand #2)

1. Porosity: 30 to 35% est.
2. Permeability: 1000 to 5000 mds. est.
3. Original Reservoir Pressure: ± 2500 psi est.
4. Reservoir Temperature: 126° F from Log
5. Chemical Character of Formation Water: No sample available
6. Reservoir Fracture Pressure: 3800 psi est. (13 ppg.)

IV. Geology & Geohydrology, continued 3.

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Recent Pleistocene				
Alluvium	100'	500'	Sand and Gravel	Good

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are five oil and gas fields located within 10 miles of the CIBA-GEIGY plant.

They are:

Field	Distance	Producing Depth
Laurel Ridge	5	10,000 to 11,000
Bayou Plaquemines	10	10,800 to 11,200
Darrow	8	4,000 to 11,000
Sunshine	4	9,700 to 10,400
St. Gabriel	3	7,700 to 11,300

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	15"	32.75#/ft H-40	10-3/4"	915	425 Sk. 50-50 Litepoz + 4% Gel
Intermed.	9-7/8"	24.40#/ft N-80	7-5/8"	5415	300 Sk. Class "A" + 3% $CaCl_2$
~~Xxxxxxxxx~~ Liner	Initial 6% Underreamed to 9"	Hasteloy "C"	5½"	5640	1st Stage: 213 Sk Trini Lt. Wght.
			420 gal. K-70-71 Plastic		315 Sk. Clas "H"
Injection:	11#/ft, J-55, 4" 5364' Penton coated				2nd Stage: 540 sk. Trini Light Weight
Other					

Describe bottom hole completion method: Perforations 5586 to 5630 with 8 shots/ft. 2-7/8" O.D. Hastelloy inside screen from 5548 to 5630' with 2 stage gravel pack.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Baker "Lok-Set" Packer (Penton coated) with 30 feet 2-3/8" Hastelloy "C" tailpipe. Casing head cmt. 10-3/4" x 7-5/8". 3" - 6000# ASA Titanium Master Valve. 3" - 3000# ASA Hast C gate valve Ladish #375

VI. Description of surface equipment

A. Holding tanks & flow lines 2 - 15,000 gal rubber-lined horizontal holding tanks, kynar lined steel piping

B. Filters 2 - diatomaceous earth vacuum, 2 banks of 3 each cartridge guard filters

C. Pumps 2 - Durco Hi Silicon Iron acid pumps; 2 teflon-lined Gould pumps; 3 Sundyne injection pumps

D. Other

VII. Cores, samples, & Logs

A. Coring No cores recovered

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs None

____Drillers Log ____Drilling time

____Sample log ____Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

X Caliper

___ Other ___

X Gamma ray-neutron

___ Temperature

___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of agricultural chemicals

B. Physical & chemical Description

Waste consists of 14% hydrochloric acid(aqueous solution). Suspended solids content approximately 10-50 ppm. Traces of ammonium chloride, chlorine, hydrogen cyanide, and cyanogen chloride are also present.

C. Volume

Average - 90 gallons per minute

Maximum - 180 gallons per minute

IX. Preinjection waste treatment

The stream is cooled to 100°F, diluted to 3-6% HCl strength, filtered and injected into the well.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection Test #1		5300' Sand #2	336 gpm @ 880 psi
#2		5300' Sand #2	252 gpm @ 740 psi
#3		5300' Sand #2	336 gpm @ 460 psi
#4		5300' Sand #2	378 gpm @ 580 psi
#5		5300' Sand #2	357 gpm @ 790 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
5300' Sand #2	Acidize with 15% HCl & Mud Acid	10,000 gal of HCl
		5,000 gal of Mud Acid

C. Injection rates and pressures

1. Rate

	Date(s)		Average		Maximum
Date(s)	10-27-70	Average	139 gpm	Maximum	225 gpm
"	12-18	"	140	"	160
"	4-24-71	"	313	"	360
"	5-21	"	214	"	332
"	6-19	"	112	"	136

2. Pressure (well head X bottom hole ______)

	Date(s)		Average		Maximum
Date(s)	10-27-70	Average	567 psig	Maximum	700 psig
"	12-18	"	696	"	735
"	4-24-71	"	598	"	600
"	5-21	"	386	"	600
"	6-19	"	783	"	800

X. Well operation & operating history

D. Description of operating programs:

Continuous injection of 5% HCl at a rate of 180 to 360 gpm depending on amount of plant effluent.

E. Operating problems:

Well has plugged with sand or other materials (drilling mud, baroid, etc.) twice. First case of plugging was corrected by ajor workover operation that included removing injecting tubing and washing out screen. Well now off due to second occurrence of plugging.

XI. Regulatory aspects.

A. Construction requirements

See permit to drill which contains approved well design

B. Monitoring requirements

None required. Monitor on annulus pressure. Monitor on fresh water in vicinity.

C. Restrictions on operating procedure

None

XII. Economics

A. Total & unit costs of construction

$460,000

B. Operating costs

$290,000 per nine months operation (includes major work over)

XIII. Source(s) of Information and Published References

1. "Ground Water in Louisiana". Water Resources bulletin #1 published by Louisiana Geoliqical Survey and La. Dept. of Public Works, 1960
2. CIBA-GEIGY company records.
3. Well logs.

I. Operating Company & General Well Location

RUBICON CHEMICALS, INC.

GEISMAR PLANT

GEISMAR, LOUISIANA

II. Well location (legal description)

Township 10S Range 2E Section 11

Ascension Parish, Louisiana

III. History; system planning, construction & operation.

A. System Planning - A feasibility study was conducted to establish the following:

1. Suitable formation for disposal including impermeable confining beds, no lateral problems and a receiving aquifer of adequate thickness, areal extent, porosity and permeability.

2. Compatibility of the proposed waste effluent with the formation brine.

3. Well location, surface facilities and materials of construction.

B. Construction - Construction was started on 11-16-70 with drilling started 11-26-70. The well was completed on 12-14-70.

C. Operation - Injection of waste effluent was initiated on Jan. 17, 1971

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located within the Mississippi structural trough of the Gulf Coastal geosyncline. The stratigraphic section consists of sands and shales of Eocene to Recent age.

17. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included -yes____; no_X_).
(Ground elevation + 23' MSL) (Total well depth 3950)
Datum for depth measurement ________

Name	Age	Depth (top)	Thickness	Lithologic Description
	SEE IES ATTACHED			

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
	MIOCENE	3600	240 Ft.	25 MILES x 35 MILES
				BLANKET SAND

D. Engineering description of injection units

1. Porosity: 30% Approx.
2. Permeability: 5000 millidarcies
3. Original Reservoir Pressure: 1700 psi
4. Reservoir Temperature: 100°F
5. Chemical Character of Formation Water: Brine
6. Reservoir Fracture Pressure: Not Applicable

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
		SEE [illegible] ATTACHED		

F. Mineral Resources (oil and gas, coal, brines, etc.)

BRINE

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	17-1/2	48.0#/Ft.	H40	13-3/8	602 Ft.	635 Sacks Type A
Intermed.	12-1/4	36.0#/Ft.	K55	9-5/8	3605 Ft.	1150 Sacks Type A
Injection		23.0#/Ft.	K55	7	3553 Ft.	
Other	Conductor Casing .303" Wall			20"	93 Ft.	

Describe bottom hole completion method: 200' - 6-5/8" O.D. [illegible] - Johnson Screen and gravel pack. 14" diameter underreamed hole with 645 cubic feet of gravel.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Packer - 7" x 9-5/8" Retrievable Pin w/Hold up Slips

Centralizers on 13-3/8" O.D. and 9-5/8" O.D. casing strings at approx. 90' intervals.

Well Head - Cameron 2000# WP

VI. Description of surface equipment

A. Holding tanks & flow lines 1 ea 825,000 Gal. C.S. Buffer Storage Tank, 1.5 x 10^6 Gal. Emergency Reservoir.

Flow to Stg. Tank or Reservoir is Under pH Control to Maintain a pH of 5 to 7.

B. Filters 2 ea. Hayward Mod. S-400 Downflow Sand Filters w/Automatic Controls.

C. Pumps 2 ea. Durco Mod. 3 x 1½ - 13/106 Centrifugal Injection Pumps, 1 ea. Durco Mod. 3 x 2 S-10/86 Reservoir Drain Pump.

D. Other Disposable Element Guard Filter.

Back-Up Elect. Power w/Automatic Switch-Over.

VII. Cores, samples, & Logs

A. Coring

From	3600	to	3890	Recovery	Good
"					
"					
"					
"					
"					

B. Drilling Logs

X Drillers Log

X Sample log

___ Drilling time

X Other: Deviation Surveys

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

X Caliper

Other

Gamma ray-neutron

Temperature

X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste process streams from nitrobenzene, aniline, Diphenylamine, Toluene Diamine, Toluene Diisocyanate, Dinitrotoluene, and Diphenylmethane Diisocyanate processes.

B. Physical & chemical Description Light amber in color, specific gravity approx. 1.0 containing the following: Approx. 2% total solids (1.7% inorganic salts and 0.3% organic). Inorganic salts are primarily sulfates, chlorides and nitrates. Organic phase is nitrobenzene, dinitrotoluene, toluene diamine, aniline, nitrocresols, chlorinated hydrocarbons, and diphenylamine.

C. Volume 500 gpm (presently only the nitrobenzene waste stream is being disposed of in the deep well at a rate of 50 gpm). Full rates will be achieved sometime prior to December, 1972.

IX. Preinjection waste treatment Waste streams will be collected in an 825,000 gallon storage tank. 85% of the suspended solids will be removed by settling. The overflow (less 85% solids) will be pumped through sand filters to remove suspended solids larger than 10 micron size prior to deep well inject. Pretreatment installation is presently still under construction.

X. Well operation operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Continuous Flowmeter	1 hour	3624 - 3840	500 gpm @ 200 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
	NONE	

C.* Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Date(s)	5/14/71	Average	52 gpm	Maximum	60 gpm
"	5/25/71	"	51 gpm	"	60 gpm
"	6/3/71	"	42 gpm	"	50 gpm
"	6/18/71	"	41 gpm	"	50 gpm
"	6/21/71	"	40 gpm	"	50 gpm

2. Pressure (well head X bottom hole ____)

Date(s)	5/14/71	Average	80	Maximum	80
"	5/25/71	"	80	"	80
"	6/3/71	"	80	"	80
"	6/18/71	"	80	"	80
"	6/21/71	"	80	"	80

* Above rates and pressure are based only on present operation of disposal of the waste nitrobenzene stream. When full pretreatment facility is commissioned, injection rates will be approximately 500 gpm at a pressure of 250 psi.

X. Well operation - operating history

D. Description of operating programs: Since the well was commissioned in January 1971, only the nitrobenzene waste stream has been injected into the well. After the completion of the pretreatment facility, total disposal of our chemical process streams will be deep well injection. The full operation of the deep well should be realized sometime prior to December, 1972.

E. Operating problems: NONE

XI. Regulatory aspects.

A. Construction requirements Tested 13-3/8" O.D. casing at 500 psi and 9-5/8" O.D. casing at 1000 psi. Tested Packer. Permit received based on casing program; geologic data, protection of fresh water sands and analysis of waste effluent.

B. Monitoring requirements Annulus between 9-5/8" O.D. casing and 7" O.D. casing is monitored by observing pressure gauge.

C. Restrictions on operating procedure NONE

XII. Economics

A. Total & unit costs of construction

Construction of Deep Well	$160,000
Construction of Pretreatment Facility	$175,000
TOTAL COST	$335,000

B. Operating costs $110,000 per year.

XIII. Source(s) of Information and Published References

~~NOT APPLICABLE~~

Louisiana Geological Survey

WELL FILE NUMBER

STATE

L-36
UMR

I. Operating Company & General Well Location

Hercules Incorporated

Iberville Parish, Louisiana

II. Well location (legal description)

1,600' FSL & 300' FEL of Sec. 13

Section 13, Township 9S, Range 13E

III. History; system planning, construction & operation.

Planning: An oil well consulting firm was engaged to study the problem and recommended a plan.

Construction: Drilling was begun on June 15, 1970, and finished on June 28, 1970. Due to a break in the liner, completion was delayed until July 28, 1970.

Operation: Operation commenced on December 18, 1970. Maximum flow rate to date has been 128 gpm. Quantity injected to date has been 8,967,000 gallons. The sand filter under drain strainers failed on April 15, 1971, which allowed sand to pass into well, resulting in high injection pressure. The well was logged at this time and sand was bailed.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the axis of the Mississippi structural trough of the coastal plain. The stratigraphic section consists of sands, clays and shales of Miocene, Pliocene, and Pleistocene ages. The regional dip is toward the southwest.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation_________) (Total well depth 4404 ft.)

Datum for depth measurement________________

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Alluvium	Quarternary	0	600'	sand and clay
----	Pliocene	600'	5200'	sand and gravel
----	Miocene	5200'	6002'	sand and shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
----	Miocene	4293"	157'	sands

D. Engineering description of injection units

1. Porosity:____________
2. Permeability:____________
3. Original Reservoir Pressure:____________
4. Reservoir Temperature:____________
5. Chemical Character of Formation Water:____________
6. Reservoir Fracture Pressure:____________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Alluvium	0'	500'	sand and gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources were reported.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20" OD	94#, H-40API ST&C	20"	124'	Driven to Refusal
Intermed.	18"	75#, J-55API ST&C	16"	790'	270 Sacks Lite-Weight + 270 Sacks Class A Commo
Injection	10-3/4" Casing, .64" Wall, LT&C		7-5/8 OD	4404	350 Sacks Class H w/12%
		Vinyl Ester Resin			Gel, 1% CFR-2 and Retar
		Filament Wound Fibercast Tubing			+ 100 Sacks Resin Cemen + Retarder
Other	15"	51#, J-55API	10-3/4	4293	1,073 Sacks Lite-Weight Followed by 520 Sacks L

Describe bottom hole completion method: Under reamed open hole below 10-3/4" casing to 17" dia., set cement plug and drilled central hole to 9-5/8" dia. to 4404'. Plugged back total depth - 4404'. Original total depth - 4450'.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines Two 242,000 gallon hold tanks, carbon steel, with interior lining 3" Fibercast and Alloy 20 piping.

B. Filters Two sand filters and two cartridge polishing filters.

C. Pumps Transfer pump - 200 gpm at 70 psi; injection pump - 200 gpm at 200 psi. The two pumps are in series.

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

___ Sample log

___ Drilling time

___ Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

_X__Caliper ____Cement bond

____Other ____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Thiophosphate process.

B. Physical & chemical Description

pH Range - 0.5 to 6.6

Total Solids - 0.74 to 1.55%

Sp. Gr. - 1.001 to 1.014

Waste liquid contains various sulfur and phosphorus compounds not identified and trace amounts of arometric solvents.

C. Volume To date, 8,967,000 gallons have been injected.

IX. Preinjection waste treatment pH adjustment by addition of hydrochloric acid.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Injection	Sanfix	
Injection	Buffer Zone	Pumped into well 12,400 barrels of potassium chloride solution (7#/barrel).

C. Injection rates and pressures

1. Rate (gpm)

Date(s)		Average		Maximum
1-1-71	Average	32	Maximum	32
2-17-71	"	86	"	108
3-11-71	"	63	"	84
4-4-71	"	43	"	52
5-24-71	"	35	"	48

2. Pressure (well head ____________ bottom hole ____________) psi

Date(s)		Average		Maximum
1-1-71	Average	70/1917	Maximum	70/1917
2-17-71	"	94/1944	"	118/1967
3-11-71	"	114/1967	"	134/1985
4-4-71	"	98/1958	"	106/1969
5-24-71	"	108/1973	"	116/1981

X. Well operation & operating history

D. Description of operating programs: Steady flow to dispose of wastes generated.

E. Operating problems: The operating problems have been associated with surface equipment due mainly to the corrosive nature of the injected fluid handled.

XI. Regulatory aspects.

A. Construction requirements Permit required from Louisiana Department of Conservation.

B. Monitoring requirements Semi-Annually: daily average waste, total waste, cumulative total waste, and chemical composition of waste.

C. Restrictions on operating procedure None

XII. Economics

A. Total & unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Louisiana Geological Survey

WELL FILE NUMBER
Cities Service Waste Disposal
Well No. 2

Louisiana
STATE

L-37
U.S.R

I. Operating Company & General Well Location

CITIES SERVICE OIL COMPANY, LAKE CHARLES OPERATIONS
LAKE CHARLES REFINERY
P. O. BOX 1562
LAKE CHARLES, LOUISIANA

II. Well location (legal description)

Township 10S, Range 9W, Section 19
Calcasieu Parish, Louisiana

III. History; system planning, construction & operation.

A. SYSTEM PLANNING. A feasibility study was initially conducted to ascertain the following:

1. Suitable formation available for disposal, confirmation of impermeable confining beds, no lateral problems and a good thickness of the receiving aquifier together with good permeability and porosity.
2. Suitable compatibility of the proposed effluent with the formation brine.
3. Plant location studies and materials of construction evaluations.

B. CONSTRUCTION. Rig moved in 9-15-70 and commenced drilling 9-23-70. Completed hole on November 22, 1970. Conducted operational tests from 11-22-70 to 2-1-71.

C. OPERATION. Operation to date has been with fresh water injected into the well. Construction of surface facilities to treat waste effluent currently being completed.

IV. Geology & Geohydrology

RECEIVED
[illegible] 22 1971

A. Regional geologic setting:
Salt dome outer flank.

The well is located on the outer flank of a salt dome seated in Miocene sands and gravels [illegible] at the southern edge of the Gulf Coastal Plain.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation ± 19'-0"MSL) (Total well depth 5,245)

Datum for depth measurement Ground level.

Name	Age	Depth (top)	Thick-ness	Lithologic Description
	SEE IES ATTACHED.			

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
	MIOCENE	4,775'	200'	BLANKET SAND

D. Engineering description of injection units

1. Porosity: 30%
2. Permeability: 6,000
3. Original Reservoir Pressure: 2,300 psi
4. Reservoir Temperature: 120° F.
5. Chemical Character of Formation Water: BRINE
   7.3 pH, 48,000 ppm Cl, 3,100 ppm Ca, 1,600 ppm Mg
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
		SEE IES ATTACHED.		

F. Mineral Resources (oil and gas, coal, brines, etc.)

BRINE.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20"	65#/ft., H-40	16"	1,110'	865 Sacks Class A Modifi
Intermed.	14-3/4"	40.5 (3,000') K-55 45.5 (1,000') K-55 51.0 (900') K-55	10-3/4"	4,782'	2,185 Sacks Class A Modifi
Injection		26.4 K-55	7-5/8"		-

Other 24" Conductor Casing - 70'

Describe bottom hole completion method: 18" Diameter Underreamed Hole, 6-5/8" O.D. UOP - Johnson Screen and 396 cubic feet of gravel.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Packer - 7-5/8" X 10-3/4" Retrievable Pin w/Hold up Slips

Centralizers - 16" and 10-3/4" Strings - Approx. 90' Intervals

Well Head - Cameron

VI. Description of surface equipment

A. Holding tanks & flow lines 3,000 Barrel Hemispheroid

26' Ø X 32' High, Carbon Steel, Epoxy Lined

Flow Lines All Carbon Steel

B. Filters 4 - 400 GPM Epoxy Lined Sand Filters

6' Ø X 5' T-T, Carbon Steel

C. Pumps Centrifugal Injection Pumps

800 GPM, 500 psig

D. Other Backwash Pit and Pump, Backwash Tank and Pump and

Fresh Water Tank and Pump

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
3,686'	3,758'	Good
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers Log

X Sample log

___ Drilling time

X Other: Deviation Surveys

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

X Caliper

X Other Micro-Log and Formation Sample.

___ Gamma ray-neutron

___ Temperature

X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Oil Refining Processing Units

B. Physical & chemical Description Sour Water

1,500 ppm Ammonia, 154 ppm Phenol, 1,800 ppm Hydrogen Sulfide, 2.7 ppm Iron

C. Volume 20,000 BPD

IX. Preinjection waste treatment Oil and H_2S Removal and Filtration.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Cont. Flowmeter	1 Hour	4,805' - 4,930'	168 GPM

Additional testing on the above zone was conducted with flow rates ranging from 234 GPM to 940 GPM and pressures from 350 psig to 695 psig. Testing performed over 60 day period.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
4,805 - 4,930	Acidizing (Halliburton)	500 Gals. HCL, 1%
		Surfactant, 1,000 Gal.
		HF plus Inhibitor
		Marginal Results

C. Injection rates and pressures - Well not yet operational - See test results above.

1. Rate

Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ______ bottom hole ______)

Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: N/A

E. Operating problems: N/A

XI. Regulatory aspects.

A. Construction requirements Tested 16" Casing at 700 psi, 10-3/4" Casing at 1,100 psi, Tested Packer.

Permit received based on casing program, geologic data and protection of fresh water sands - plant effluent composition also provided to State.

B. Monitoring requirements Annulus between 10-3/4" and 7-5/8" Casing monitored by observing pressure gage, injection rates are metered and injection pressures recorded.

C. Restrictions on operating procedure N/A

XII. Economics

A. Total & XXXXX costs of construction $275,000

B. Operating costs N/A

XIII. Source(s) of Information and Published References

Louisiana Geological Survey

WELL FILE NUMBER

STATE

L-38
UMR

I. Operating Company & General Well Location

Delta Iron Works, Inc., Industrial Blvd.,
Houma, Louisiana

II. Well location (legal description)

2,131.46' S8 degrees 29' 12" E then 743.10' S 6 degrees 33' 52" E then 575.70' N 83 degrees 26' 08" E of the Northwest corner of section 12, T-17-S, R-17-E, Terrebonne Parish, Louisiana

III. History; system planning, construction & operation.

·11-68 Ran and cemented 3054' - 10 3/4" OD 40.50# J-55 ST & C casing w/ 1850' sacks of cement in 15" hole - tested to 1500# O.K.

12-4-68 - Set cement plug from 2792' - 2992' w/ 100 sacks of cement.
(abandoned as dry hole)

5-1-71 - Perforated 10 3/4" casing from 2220 - 2245 w/ 100 holes - Hung 1023' 7 5/8" OD 26.40# J-55 ST & C casing and 2214' - 2 7/8" OD 6.5# J-55 EUE 8rd. tubing with packers and heads

As of 6-1-71 - No chemical waste injected.

IV. Geology & Geohydrology

A. Regional geologic setting: Miocene

The well is located at the southern edge of the Gulf Coastal Plain in an area of abundant salt domes. The stratigraphic section consists of sands, clays, and shales of Miocene to Pleistocene age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no____).

(Ground elevation________) (Total well depth 3054)

Datum for depth measurement 10 3/4" Casing head

Name	Age	Depth (top)	Thick-ness	Lithologic Description
	Miocene	0	3054	Sand & Shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
-	Miocene	2215'	75'	Sand

D. Engineering description of injection units

1. Porosity: Unknown
2. Permeability: Unknown
3. Original Reservoir Pressure: unknown
4. Reservoir Temperature: unknown
5. Chemical Character of Formation Water: unknown
6. Reservoir Fracture Pressure: unknown

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
None known				

F. Mineral Resources (oil and gas, coal, brines, etc.)

none known

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	15"	40.5#	J-55	10 3/4"	3054'	1850' -Class A
Intermed.		26.4#	J-55	7 5/8"	1023'	
Injection		6.5#	J-55	2 7/8"	2214	
Other						

Describe bottom hole completion method: Perforated 10 3/4" casing from 2220 - 2245 w/ 100 holes

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

10 3/4" x 7 5/8" Casing hanger

7 5/8" x 2 7/8" casing head

10 3/4" x 7 5/8" packer

10 3/4" x 2 7/8" packer

VI. Description of surface equipment

A. Holding tanks & flow lines ____ none installed

B. Filters ____ none installed

C. Pumps ____ none installed

D. Other ____ none installed

VII. Cores, samples, & Logs

A. Coring

From ____ none ____ to ____________ Recovery ____________

B. Drilling Logs

____ Drillers Log ____ Drilling time

____ Sample log ____ Other: ____ none

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity

___ SP

___ Caliper

_x_ Other Gamma Ray

___ Gamma ray-neutron

___ Temperature

___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Gas freeing of oil transport barges

B. Physical & chemical Description not available yet

C. Volume not available yet

IX. Preinjection waste treatment None installed

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	5 min.	2220 - 2245	150 bbls./min. fresh water w/ 0 PSI

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) ______ Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

2. Pressure (well head ______ bottom hole ______)

Date(s) ______ Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

X. Well operation & operating history

D. Description of operating programs: Not in Operation

E. Operating problems: Not in operation

XI. Regulatory aspects.

A. Construction requirements As prescribed by Louisiana Department of Conservation and Louisiana Board of Health

B. Monitoring requirements

C. Restrictions on operating procedure

Economics

A. Total & unit costs of construction

$ 11,000 not including dry hole — No surface equipment has been installed

B. Operating costs Not in operation

Source(s) of Information and Published References

WELL FILE NUMBER ______ STATE ______ L-39 UMR

I. Operating Company & General Well Location

Georgia-Pacific Corporation, Rebecca Plant in Iberville Parish, Louisiana

1971

II. Well location (legal description)

Section 15, Township 95, Range 13E of Iberville Parish, Louisiana

III. History; system planning, construction & operation.

The well was installed as integral part of a "grass roots" chemical plant. Deep Well Pollution Control Corporation was selected to design, specify, and act as engineering project managers for the well construction. Construction of the subject well began in June, 1970, and was completed in August, 1970. The well then sat dormant until April, 1971, while other facilities in plant were being completed. Based on compatibility testing with the anticipated waste water and formation brine, a front of chemically purified well water (14 million gallons) was injected into the well ahead of the waste to form a buffer zone between the two waters. However this injection was interrupted to reseat the packer which was leaking. Also the well receptivity declined during this period to the point where well was acidized and backflowed (by nitrogen injection) to restore well receptivity. Waste flow to the well commenced in early July, 1970 and has intermittently been continued since that time. During a well backflow large quantities of sand were brought up and a new screen was set approximately 35 feet off the original screen. Operation has continued at rates of 120 gpm.

IV. Geology & Geohydrology

A. Regional geologic setting:

The well is located in the southern margin of the Gulf Coastal Plain in an area of numerous salt domes. The stratigraphic section in this area consists of sands, clays, shales, and gravels of Tertiary and Quaternary ages.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ____; no 0).

(Ground elevation 0) (Total well depth 3,596)

Datum for depth measurement E. B. Measurement

Name	Age	Depth (top)	Thickness	Lithologic Description
		SEE ATTACHED TABLE I		

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
		SEE ATTACHED TABLE I		

D. Engineering description of injection units

1. Porosity: 25-40%
2. Permeability: Not known
3. Original Reservoir Pressure: Not known
4. Reservoir Temperature: Not known
5. Chemical Character of Formation Water: Specific gravity 1.C74, total dissolved solids 108,000 ppm resistivity 0.084, pH 6.3 -- Dissolved solids analysis sodium 39,000 ppm, barium 70 ppm, calcium 2,140 ppm, magnesium 670 ppm, chloride 56,000 ppm.
6. Reservoir Fracture Pressure: Not known

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
			Not known	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Not known

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20"	H-40, 65#/Ft., LT&C, R-3	16	791	La.Common F/N.O.,La.728 [illegible] Salt blended 3% in cemt 21 [illegible] Halliburton Gel 8% blended in 628 [illegible] 1-2 grout mix -- 6 cu.yd.
Intermed.	[illegible]-1/2"	J-55, 36#/Ft., LT&C, R-3	9-5/8	3435	3430-1800' 960 cu.ft.Pozmix [illegible] Nacl&1800 cu.ft.Pozmix18% N[illegible]
Injection		J-55, 14#/Ft., LT&C, R-3	9-1/2	3304	- - - - - - - - - - -
Other	5-1/2	J-55, 46#/Ft., R-8	2-3/8	300	- - - - - - - - - - -

Describe bottom hole completion method: 155' of slot 20, 316 S.S., 6-5/8 O.D. well scr[illegible] [illegible] blank riser affixed to 5-1/2 inch dispofal string. Open hole outside [illegible] un[illegible]reamed to 20" avg. and gravel packed with Texblast TCM 175 coarse [illegible] to [illegible] inch gravel).

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: An Otis MR9001 9-5/8" x 5-1/2" set-down expandable packer was employed to isolate 5-1/2 inch injection tubing from 9-5/8 inch casing.

VI. Description of surface equipment

A. Holding tanks & flow lines Aqueous wastes from various plant sources are received into a carbon steel waste settler tank which is 20 ft. in diameter by 24 ft. high. Wastes are injected into the well through 3 inch carbon steel piping.

B. Filters Two paralled sand bed filters (each containing a sand bed 3.5 feet in diameter by 6 feet tall) are employed to filter the waste streams prior to well injection.

C. Pumps Two 150 gpm, 190 psi AP pumps (one pump acts as spare) were included in original well design. A third injection booster pump (350 gpm, 216psi AP) was since added and operates in series with original pumps.

D. Other

VII. Cores. [illegible]les, & Logs

A. [illegible]ing

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

___ Drilling Log ___X Drilling time

___ Sample Log ___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

SP

X Caliper

x Other Density, Sonic

Gamma ray-neutron

Temperature

X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Principle waste streams originate in a cumene derived phenol production unit.

B. Physical & chemical Description The process waste is primarily an aqueous stream having following analysis:

Phenol	--	1.45% wt.
Cumene Hydroperoxide	--	0.03% wt.
Acetone	--	0.06% wt.
Sodium Phenolate	--	0.08% wt.
Sodium Carbonate	--	0.63% wt.
Sodium Sulfate	--	0.81% wt.
Sodium Hydroxide	--	0.24% wt.

C. Volume

Design volume waste streams is 77 gpm. Design injection rates to well is 300 gpm to provide for intermittently received wastes, rain runoff, sand filter backflushes, disposal well downtime, etc.

IX. Preinjection waste treatment

Approximately 2/3 of design waste streams is treated in an API Separator prior to pumping to the waste settler tanks. The remaining streams are received directly into the waste settler tank which should provide some gravity separation itself. The entire well feed is then filtered in the sand filters enroute to the disposal well.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection		Injection Zone	500 gpm

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Injection zone	Acidization followed by backflow.	1400 gallons of 12% hydrochloric acid injected into well bore & allow to set approx 12 hrs. Well backflowe with gas lift on 27 hrs. Well receptivity restored. Well backflowed for
Injection zone	Backflow	18 hrs using gas lift. Well receptivity improved.

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
4/10-5/5/71	197 gpm	244 gpm
5/5/71 - Present	100 gpm	200 gpm

2. Pressure (well head 36 psig bottom hole ca 1300 psig

Date(s)	Average	Maximum
4/10-5/5/71	200 psig	200 psig
5/5/71 - Present	400 psig	430 psig

X. Well operation & operating history

D. Description of operating programs: Aside from injecting the purified water to serve as buffer between waste streams and formation brine, it is our intent to inject continuously into the disposal well with daily monitoring of injection rates and pressures. Composition of waste streams are also analyzed daily, particularly noting filterable solids content.

E. Operating problems: Difficulty has been experienced in sustaining injection rates to disposal well. Backflowing the well (using gas lift) has restored well receptivity. Some mechanical problems in the surface sand filters has been discovered which resulted in sand and other solids being injected into well. Filter revisions are underway which should alleviate solids being fed to the well. Present intent is to neutralize well feed since there is evidence of $CaCO_3$ plugging of well.

XI. Regulatory aspects.

A. Construction requirements Outer casing cemented to below 790 feet Intermediate casing cemented to below 2,500 feet.

B. Monitoring requirements Pressure between outer casing and injection tubing maintained above well-head pressure to assure no leakage of contaminants into other than injection strata.

C. Restrictions on operating procedure Oily substances removed, solids filtered from well feed. Well operation is monitored to assure safe operation. Well design intended to give trouble free operation.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Written communication - Louisiana Geological Survey

WELL FILE NUMBER

STATE | L-40 UMR

I. Operating Company & General Well Location

[redacted] Cotton Valley Operators Committee

Cotton Valley Field - Webster Parish, Louisiana

II. Well location (legal description)

Ohio Oil Company-Gray Ac.1B No. 25

1980' S & 660' E of NW Corner 26-21N-10W

Permit No. 22857 8-2-39

III. History; system planning, construction & operation.

The well was drilled by Ohio Oil Company in 1939 and completed in the Travis Peak 5600' - 5608' and 5636' - 5646'. The well was purchased by Hyman Muslow and the zones were depleted. Cotton Valley Operators Committee purchased the well from Muslow.

A work permit was requested to convert the well to disposal in the Buckrange sand.

A correlation log was run and a bridge plug set at 2700 feet. The Buckrange was perforated from 2538 feet to 2558 feet.

The disposal system including pits, pumps, and water lines were installed and injection of approximately 5000 barrels per day of water was begun on May 21, 1971.

IV. Geology & Geohydrology

A. Regional geologic setting:

The well is located on the northeast flank of the Sabine uplift within the Gulf Coastal Plain. The regional dip in this area is to the northeast. The stratigraphic section consists of sands, clays, and shales of Cretaceous and Tertiary age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ____; no x).

(Ground elevation 242) (Total well depth 5749)

Datum for depth measurement Rotary - Table

Name	Age	Depth (top)	Thickness	Lithologic Description
Cook Mountain				
Sparta Cane River				
Wilcox				
Arkadelphia				
Nacatosh Saratoga		1700	200	Sand
Mailbrook				
Annona				
Ozan				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Buckrange	Ozan	2538	20	Total field
Nacatosh	-	1700	200	Total Area

D. Engineering description of injection units

1. Porosity: 25 per cent estimated
2. Permeability: 100 millidarcy average estimated
3. Original Reservoir Pressure: 1500 psi estimated
4. Reservoir Temperature: 130° F.
5. Chemical Character of Formation Water: Unknown
6. Reservoir Fracture Pressure: 2000 psi estimated

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Sparta	80	220	Sand & Gravel	30-300 ppm chlorides

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil, gas, gravel, iron ore - are produced in the area

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface	12-1/4	47.6#	9-5/8	615	-
Intermed.	8-3/4	18	5	5732	-

Injection None

Other

Describe bottom hole completion method: Perforated with 80 holes jet gun

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ___

No packers

Cameron Iron Works tree

VI. Description of surface equipment

A. Holding tanks & flow lines Three concrete oil water separation pits, one earth pit, one concrete suction pit. Four inch steel line to second stage pump and three inch steel line to injection well.

B. Filters 1 - Crall 12-9-27P discharge filter

C. Pumps Two electric driven Ingersoll Rand pumps
One Gaso pump for second stage

D. Other ___

VII. Cores, samples, & Logs

A. Coring

From ___ to ___ Recovery ___

B. Drilling Logs

___ Drillers Log ___ Drilling time

___ Sample log ___ Other: ___

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Gasoline Plant, Recycling Project

B. Physical & chemical Description

Temp - 42 °C	Total Solids 1602	Iron 2.9
PH - 9.5	Dissolved Solids 1552	Chromium 5
Color - 52.9	Suspended Solids 50	
Odor - 6	Sulphate 341	
Turbidity - 4.5	Sulfite 2.5	
Alkalinity (a $CaCO_3$) 150	Chloride 131	
Total Hardness 336	Calcium 208	

C. Volume 5000 Barrels per day

IX. Preinjection waste treatment Biocide and filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s) September 6, 1971 Average 160 GPM Maximum 160 GPM

2. Pressure (well head 300 PSIG bottom hole 1400 PSIG

Date(s) September 6, 1971 Average 300 PSIG Maximum 400 PSIG

X. Well operation & operating history

D. Description of operating programs: Water is gathered to one final pit. Water is pumped by two pumps on level control and discharged into final pump. Final pump operates on pressure control to vary pump speed. Water is filtered and injected into well.

E. Operating problems:

I. Bacteria control

II. Suspended Solids

III. Oil in water

IV. Plugging perforations with solids

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure None reported

XII. Economics

A. Total & unit costs of construction

$30,000 Total

B. Operating costs

$15,000 per year

XIII. Source(s) of Information and Published References

Louisiana Geological Survey

WELL FILE NUMBER BD-43 STATE Mc-1 UMS

I. Operating Company & General Well Location

Marathon Oil Company - formerly Old Dutch Refining Company
Muskegon, Michigan

II. Well location (legal description)

Location: SE 1/4, SW 1/4, SE 1/4, Sec. 26, T10N, R16W, Muskegon Township, Muskegon County, Michigan.

III. History, system planning, construction & operation.

The well began disposing of waste effluent from the Old Dutch refinery in September, 1948. The well was plugged and abandoned in 1951. There was no reason given for abandoning the well. The refinery was torn down in 1968.

IV. Geology & Geohydrology

A. Regional geologic setting: Beds in the Michigan Basin at the well site dip toward the northeast. A large anticline is located north of the well site.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no_X_).

(Ground elevation________) (Total well depth 2346 ft.)

Datum for depth measurement Ground level

Name	Age	Depth (top)	Thickness	Lithologic Description
Coldwater	Devonian	673ft.		limestone
Traverse	Devonian	1758ft.	372ft.	limestone
Dundee	Devonian	2130ft.		
Detroit River	Devonian			

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Traverse	Devonian	1758		limestone and dolomite
Dundee	Devonian	2130		widely distributed in
Detroit River	Devonian			Michigan basin

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	Pleistocene			
Marshall	Mississippian			

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas pools are located near the well site.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		42lb/ft.	10in.	440ft.	
Intermed.		30lb/ft.	8in.	605ft.	
		18lb/ft.	6in.	703ft.	
Injection		14lb/ft.	5in.	1758ft.	

Other

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____

VI. Description of surface equipment

A. Holding tanks & flow lines 500 bbl underground tank and a 5,000 bbl settling and skimming tank.

B. Filters Strawboxes

C. Pumps ____

D. Other ____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity
____SP
____Caliper
____Other ____________________
____Gamma ray-neutron
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Oil refinery waste effluent

B. Physical & chemical Description Refinery water and surface flood waters

C. Volume ____________________

IX. Preinjection waste treatment Settling and skimming

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
	60-65gpm	
"	" Estimated	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ______ bottom hole ______)

Date(s)	Average	Maximum
	None	
"	" Recorded	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction ______

B. Operating costs ______

XIII. Source(s) of Information and Published Reference ______

Michigan Geological Survey

Michigan Water Resources Commission

WELL FILE NUMBER [illegible]-52 / [illegible] Mc-2 / UWF

I. Operating Company & General Well Location

Park, Davis, and Company

Holland, Michigan

II. Well location (legal description)

Location: SW 1/4, SW 1/4, SW 1/4, Sec. 20, T5N, R15W, Holland Township, Ottawa County, Michigan

III. History, system planning, construction & operation.

Park, Davis, and Company proposed the well to dispose of the waste effluent from their chemical production operations. The well was completed and began operating in May, 1951. The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Beds in the Michigan Basin in the vicinity of the well site dip toward the northeast.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well Rock Unit (Geologic Column included -yes____; no X).
(Ground elevation 588 ft.) (Total well depth 1635 ft.)
Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
drift	Pleistocene	0ft.	115ft.	sand, mud, & gravel
Coldwater	Mississippian	115ft.	448ft.	dolomite
Ellsworth	Mississippian	563ft.	637ft.	shale
Antrim	Mississippian	1200ft.	180ft.	shale
Traverse	Devonian	1380ft.	254ft.	shale and limestone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Traverse	Devonian	1380ft.	254ft.	limestone and dolomite

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 152,000 mg/l Cl, 20 mg/l Fe, 235,950 mg/l TDS, Specific Gravity 1.16
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	0	115	sand, clay & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		42lb/ft.	10 1/2in.	125ft.	
Intermed.		17lb/ft.	7 in.	1435ft.	
Injection			2 in.		

Other the annulus is filled with fresh water

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ________

VI. Description of surface equipment

A. Holding tanks & flow lines Wooden settling and aging tanks

B. Filters Wooden sand filters

C. Pumps ________

D. Other ________

VII. Cores, samples, & Logs

A. Coring

From ________ to ________ Recovery ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________

B. Drilling Logs

X Drillers Log ____Drilling time
____Sample log ____Other: ________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other ____________________

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

The waste is derived from the manufacture of chloromycetin.

B. Physical & chemical Description The effluent contains sodium, acetate, chloride, ammonia, bromide, and unidentified organic compounds.

60,000ppm TDS

BOD 45,000ppm

pH 3.7

C. Volume 22.8 thousand gallons during 1969

IX. Preinjection waste treatment Filtration, aeration, settling, and pH adjustment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Traverse	Buffer injection	50gpm of Fresh water for several weeks

C. Injection rates and pressures

1. Rate

Date(s) ______ Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

2. Pressure (well head X bottom hole ______)

Date(s) ______ Average 280psi Maximum 400psi

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

X. Well operation & operating history

D. Description of operating programs: ____________________

E. Operating problems: Some trouble with corrosion above ground.

XI. Regulatory aspects.

A. Construction requirements ____________________

B. Monitoring requirements The pressure is checked daily.

C. Restrictions on operating procedure ____________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Geological Survey

Adinoff 1955

Michigan Water Resources Commission

WELL FILE NUMBER MD-118 / STATE Mc-3 / UWN

I. Operating Company & General Well Location

Park, Davis, and Company
182 Howard Avenue
Holland, Michigan

II. Well location (legal description)

Location: SW 1/4, SW 1/4, SW 1/4, Sec. 20, T5N, R15W, Holland Township, Ottawa County, Michigan

III. History, system planning, construction & operation.

This is the second well at the pharmaceutical plant which disposes of chemical waste.

The well was drilled and completed in October, 1956 and began operating soon after completion. The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The regional dip of the beds at the well site is to the northeast. Th well is situated on the west flank of the Michigan Basin.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes___; no X).

(Ground elevation________) (Total well depth 1946 ft.)

Datum for depth measurement________

Name	Age	Depth (top)	Thickness	Lithologic Description
Same as Mc-2				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Detroit River	Devonian	1649ft.		dolomite & limestone

Note: This well was reported injecting in Traverse Group and Dundee Formation; however, there is no record of this. Records indicate the long string of casing was set at 1,649 feet. If the upper zones are open, the Company must have perforated them at a later date.

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature.
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
drift	0	134	clay and gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources were reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			10 3/4in.	152ft.	60 sacks
Intermed.			7 in.	1649ft.	270 sacks
Injection		tubing			
Other					

Describe bottom hole completion method:

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other ________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as Mc-2

B. Physical & chemical Description Same as Mc-2

C. Volume 1,252,056 gal. per month during 1966 (2 wells)

IX. Preinjection waste treatment Settling, and filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)		Average	Maximum
		7gpm	30gpm

2. Pressure (well head X bottom hole)

Date(s)		Average	Maximum
		280psi	400psi

X. Well operation & operating history

D. Description of operating programs: ____________________

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements ____________________

B. Monitoring requirements ____________________

C. Restrictions on operating procedure ____________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published Reference.

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER BD-76 **STATE** Mc-4 **UMR**

I. Operating Company & General Well Location

Hooker Electro - Chemical Company

Montague, Michigan

Disposal Well #1

II. Well location (legal description)

Location: SE 1/4, NW 1/4, SE 1/4, Sec. 30, T12N, R17W, Montague Township, Muskegon County, Michigan

III. History, system planning, construction & operation.

The well was drilled and completed and began operating in April, 1956. The well was abandoned and plugged on June 18, 1969. It was plugged with 65 sacks of cement displaced through the 2 3/8in. tubing and set at 2000ft. The remainder of the hole was filled with heavy brine sludge consisting primarily of calcium carbonate and magnesium hydroxide.

IV. Geology & Geohydrology

A. **Regional geologic setting:** The regional dip is to the northeast. The well is situated on the west flank of the Michigan Basin. An anticlinal fold is located north of the well.

IV. Geology & Geohydrolcgy, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 636 ft.) (Total well depth 2066 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
drift	Pleistocene	0	290	clay, sand, and gravel
Coldwater	Mississippian	355	563	shale
Ellsworth	Mississippian	918	564	shale
Antrim	Devonian	1482	138	black shale
Traverse	Devonian	1620	446+	limestone and shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Traverse	Devonian	1703ft.		dolomite and limestone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	0	290	clay and gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are several small oil and gas pools in the vicinity of the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			18 in.	395ft.	650 sacks
Intermed.		54 lb/ft.	13 3/8in.	1703ft.	1150 sacks
Injection					
Other					

Describe bottom hole completion method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	____	to ____	Recovery ____
"	____	____	____
"	____	____	____
"	____	____	____
"	____	____	____
"	____	____	____

B. Drilling Logs

_X_ Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other ____________________

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical plant waste

B. Physical & chemical Description Sodium sulfate, sodium chloride, and calcium sulfate

C. Volume ____________________

IX. Preinjection waste treatment ____________________

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Drill Stem	7 days	1690 to 2060ft.	recovered 1540ft. of water
" "	12 hours	" "	" 1866ft. of water

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1800 to 2066ft.	Acidization	5000 gal.

C. Injection rates and pressures

1. Rate

Date(s)________ Average________ Maximum________

2. Pressure (well head ________ bottom hole________)

Date(s)________ Average________ Maximum________

X. Well operation & operating history

D. Description of operating programs: ______

E. Operating problems: The well plugged with calcium sulfate.

XI. Regulatory aspects.

A. Construction requirements ______

B. Monitoring requirements ______

C. Restrictions on operating procedure ______

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER BD-107 STATE Mc-5 UMR

I. Operating Company & General Well Location

Hooker Electro-Chemical Company

Montague, Michigan

Disposal Well #2

II. Well location (legal description)

Location: SW 1/4, NE 1/4, NE 1/4, Sec. 31, T12N, R17W, Muskegon County, Michigan.

III. History; system planning, construction & operation.

The well began operating by disposing Hooker Electro-Chemical's liquid chemical waste in May, 1956. The well was plugged and abandoned in June, 1968.

IV. Geology & Geohydrology

A. Regional geologic setting: The regional dip at the well site is toward the northeast. The well is situated on the west flank of the Michigan Basin.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 641 ft.) (Total well depth 2083 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Marshall	Mississippian	300ft.	590ft.	sandstone
Coldwater	Mississippian	890ft.	524ft.	shale
Antrim	Devonian	1414ft.	206ft.	shale
Traverse	Devonian	1622ft.	442ft.	cherty limestone & shale
Bell	Devonian	2064ft.		shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Traverse	Devonian	1622ft.	442ft.	cherty limestone and shale

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	0ft.	300ft.	clay and gravel	
Marshall	300ft.	590ft.	sandstone	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are several small oil and gas pools in the vicinity of the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			10 3/4in.	385ft.	200 sacks
Intermed.			7 in.	1996ft.	425 sacks
Injection					
Other					

Describe bottom hole completion method: perforated completion 1962 ft. to 1972 ft. (30 holes)

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From ________ to ________ Recovery ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________

B. Drilling Logs

_X_ Drillers Log

___ Sample log

___ Drilling time

___ Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

___ Caliper

X Other Microlog

X Gamma ray-neutron

___ Temperature

___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical plant waste

B. Physical & chemical Description Sodium sulfate, sodium chloride, and calcium sulfate

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1996ft. to 2068ft.	Acidization	5000 gal.

C. Injection rates and pressures

1. Rate

Date(s) ______ Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

2. Pressure (well head ______ bottom hole ______)

Date(s) ______ Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction ______

B. Operating costs ______

XIII. Source(s) of Information and Published References ______

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER BD-64 STATE Mc-6 UMR

I. Operating Company & General Well Location

Reichhold Chemicals, Inc.
Ferndale, Michigan

II. Well location (legal description)

Location: NW 1/4, SW 1/4, NE 1/4, Sec. 27, T1N, R11E, Oakland County, Michigan

III. History; system planning, construction & operation.

The well commenced disposing of phenol waste in September, 1953. The waste fluid reacted adversely with the formation water to form a precipitate which began plugging the well. In 1957, surface injection pressure became excessive and the well was plugged and abandoned.

IV. Geology & Geohydrology

A. Regional geologic setting: The regional dip at the well site is to the northwest. The well is situated on the southeast flank of the Michigan Basin and is east of the Howell Anticline.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no_X_).

(Ground elevation 640 ft.) (Total well depth 1053 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
drift	Pleistocene	0ft.	128ft.	sand, clay, and gravel
Antrim	Devonian	128ft.	94ft.	shale
Traverse	Devonian	222ft.	378ft.	cherty limestone
Dundee	Devonian	600ft.	26ft.	limestone
Detroit River	Devonian	626ft.	291ft.	dolomite
Sylvania	Devonian	917ft.	78ft.	sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Detroit River	Devonian	626ft.	291ft.	dolomite
Sylvania	Devonian	917ft.	78ft.	sandstone

D. Engineering description of injection units

1. Porosity: ____
2. Permeability: ____
3. Original Reservoir Pressure: ____
4. Reservoir Temperature: ____
5. Chemical Character of Formation Water: Specific Gravity 20° C-1.1055, Be'-13.84°, Sodium Chloride-7.41%, Calcium Chloride-3.63%, Magnesium Chloride-1.55%, Potassium Chloride-0.33%, Total Chloride Salts-12.92%, Total Solids-16.1%, Pounds of Sulfur per 1000 gal.-4.0, Sulfate and Silica-Traces.
6. Reservoir Fracture Pressure: ____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Antrim	128ft.	94ft.	shale	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are no mineral resources reported in the vicinity of the well site.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			8 1/4in.	130ft.	
Intermed.			6 5/8in.	693ft.	120 sacks
Injection					
Other					

Describe bottom hole completion method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ________

VI. Description of surface equipment

A. Holding tanks & flow lines ________

B. Filters ________

C. Pumps ________

D. Other ________

VII. Cores, samples, & Logs

A. Coring

From		to		Recovery	
"					
"					
"					
"					
"					

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other ____________________

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical waste

B. Physical & chemical Description Phenols

C. Volume ____________________

IX. Preinjection waste treatment Filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	---	922 to 986feet	131gpm at 100psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
693 to 1053ft.	Acidization	500 gal.
" "	Buffer injection	33,000 gal. - fresh water

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Date(s)	initially	Average	3.5gpm	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole ______)

Date(s)		Average		Maximum	
Date(s)	initially	Average	100psi	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: ____________________

E. Operating problems: Precipitate plugging caused the well to be abandoned.

XI. Regulatory aspects.

A. Construction requirements ____________________

B. Monitoring requirements ____________________

C. Restrictions on operating procedure ____________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER BD-87 STATE Mc-7 UMR

I. Operating Company & General Well Location

The Upjohn Company

Kalamazoo, Michigan

Disposal Well #1

II. Well location (legal description)

Location: SW 1/4, SE 1/4, NE 1/4, Sec. 14, T3S, R11W, Kalamazoo County, Michigan

III. History, system planning, construction & operation.

The liquid waste from the Upjohn Company was originally discharged into a 90 acre swamp. The disposal well was completed and began operation in May, 1954. It is presently in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated on the southern edge of the Michigan Basin. The regional dip is to the north.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 869ft.) (Total well depth 1532ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
drift	Pleistocene	350ft.		
Coldwater	Mississippian			shale
Antrim	Devonian			shale
Traverse	Devonian	1220ft.	170ft.	cherty limestone
Dundee	Devonian	1390ft.	55ft.	limestone
Monroe	Devonian	1532ft.		dolomite

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Traverse	Devonian	1220ft.	170ft.	cherty limestone
Dundee	Devonian	1390ft.	55ft.	limestone
Monroe	Devonian	1532ft.		dolomite

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
drift		350ft.	clay & gravel	fresh water

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are no mineral resources reported in the vicinity of the well site.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		42lb/ft.	10 in.	352ft.	
Intermed.		17lb/ft.	7 in.	1290ft.	
Injection		tubing	2 1/2in.	1295ft.	

Other annulus filled with fresh water

Describe bottom hole completion method: open hole completion - bottom 200 feet

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

5 Centralizers on 7in. casing

Hookwall neoprene packer at 1200ft.

VI. Description of surface equipment

A. Holding tanks & flow lines 2 surge tanks - 45,000 gal. each, a 25,000 gal. mixing tank, and a 65,000 gal. clarifier.

B. Filters Niagara polishing filter

C. Pumps 1 injection pump and 1 booster pump

D. Other

VII. Cores, samples, & Logs

A. Coring

From ______ to ______ Recovery ______

"

"

"

"

"

B. Drilling Logs

___Drillers Log ___Drilling time

___Sample log ___Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity
____SP
____Caliper
____Other____
____Gamma ray-neutron
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived
Effluent from the manufacture of cortical steroid products.

B. Physical & chemical Description The waste consists of soluble organic solvents such as alcohols, ketones, esters, ethers, dissolved inorganic salts, and acids.
5,000 to 8,000 ppm total dissolved solids
2-10,000ppm BOD
pH 2.0 to 8.0, but constantly 4.0-4.5 since 1962

C. Volume 400,000 to 700,000 gpd

IX. Preinjection waste treatment Filtration, clarification, and pH adjustment to 5.5

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1290 to 1532ft.	Acidization	3000 gal.

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Date(s)	2 Wells	Average	50gpm	Maximum	100gpm
"		"	to 100gpm	"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole)

Date(s)		Average		Maximum	
Date(s)		Average	250psi to	Maximum	1000psi
"		"	1000psi	"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: The pH was adjusted by addition of lime, but this resulted in scale development. They then switched to fiberglass tubing.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements Pressure is monitored with continous pressure recorders

C. Restrictions on operating procedure Surface pressure is limited to 1250 psi and the rate is limited to 300,000 gpd.

XII. Economics

A. Total and unit costs of construction 2 Wells - $400,000.

B. Operating costs 2 Wells - $75,000.00 per year

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Paradiso, S. J. 1956

Michigan Geological Survey

Donaldson, 1962

WELL FILE NUMBER BD-92 Mc-8

I. Operating Company & General Well Location

The Upjohn Company

Kalamazoo, Michigan

Disposal Well #2

II. Well location (legal description)

Location: SW 1/4, SW 1/4, NW 1/4, Sec. 14, T3S, R11W,

Kalamazoo, Michigan

III. History; system planning, construction & operation.

This is Upjohn's second well of a two wells system for the disposal of pharmaceuticals. This well commenced injection during May, 1954 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated on the southern edge of the Michigan Basin. The regional dip is to the north.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 869 ft.) (Total well depth 1475ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Same as Mc-7				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Same as Mc-7				

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift				

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are no mineral resources reported in the vicinity of the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		42lb/ft.	10 in.	352ft.	
Intermed.		17lb/ft.	7 in.	1290ft.	395 sacks
Injection		tubing	2 1/2in.		
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 5 Centralizers on 7 in. casing
Hookwall neoprene packer on 7 in.

VI. Description of surface equipment

A. Holding tanks & flow lines 2-45,000 gal. surge tanks, a 25,000 gal. mixing tank, and a 65,000 gal. clarifier

B. Filters Niagara polishing filter

C. Pumps 1 injection pump and 1 booster pump

D. Other

VII. Cores, samples, & Logs

A. Coring

From		to	Recovery
"			
"			
"			
"			
"			

B. Drilling Logs

____Drillers Log
____Sample log
____Drilling time
____Other: ____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other____

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as Mc-7

B. Physical & chemical Description Same as Mc-7

C. Volume Same as Mc-7

IX. Preinjection waste treatment Filtration clarification and pH adjustment to 5.5

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1276 to 1476ft.	Acidization	3000 gal.

C. Injection rates and pressures

1. Rate

Date(s)	2 Wells	Average	50gpm	Maximum	100gpm

2. Pressure (well head ________ bottom hole ________)

Date(s)	1954	Average	250psi	Maximum	
"	1956	"	1000psi	"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: The pH was adjusted by the addition of the lime, but this resulted in scale development. To alleviate this problem, fiberglass tubing was used.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements Pressure is monitored with continuous pressure recorders.

C. Restrictions on operating procedure Surface pressure is limited to 1250 psi and the rate is limited to 300,000 gpd.

XII. Economics

A. Total and unit costs of construction 2 Wells - $400,000.

B. Operating costs 2 Wells - $75,000.00 per year

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Paradio S. J. 1956

Michigan Geological Survey

Donaldson 1962

WELL FILE NUMBER BD-93 (STATE) Mc-9 (UMR)

I. Operating Company & General Well Location

Dow Chemical Company

Bay Refining Division

II. Well location (legal description)

Location: SW 1/4, NE 1/4, NE 1/4, Sec. 15, T14N, R5E, Banger Township, Bay County, Michigan.

III. History; system planning, construction & operation.

The well was completed on October 13, 1954 and began operating soon after completion. Operation has been suspended since 1967.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated near the center of the Michigan Basin. The regional dip is to the west. There is a large regional anticline near the well site.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 567 ft.) (Total well depth 4710 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
drift	Pleistocene	0ft.	98ft.	sand and clay
Saginaw	Pennsylvania	98ft.	326ft.	sand and shale
Michigan Series	Mississippian	424ft.	133 ft.	sand
Marshall	Mississippian	557ft.		sandstone
Berea	Mississippian	1791ft.		sandstone
Antrim	Mis.-Devonian	1963ft.	178ft.	shale
Traverse, Dundee, Detroit River	Devonian	2307		limestone, dolomite, shale & sandstone
Sylvania	Devonian	4425ft.		sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Sylvania	Devonian	4425ft.	285ft.	sandstone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Dundee				
Saginaw	98ft.	326ft.		
drift	0ft.	98ft.	clay, sand, & gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	14in.		14 in.	97ft.	
Intermed.			10 3/4in.	891ft.	600sks-surface
		J-55 23lb/ft.	7 in.	1272ft.	
Injection		14lb/ft.	5 in.	4026ft.	

Other

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

Centralizers at 2900, 2936, 2995, 3034, 3694, and 3772ft.

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Gamma ray-neutron

____Temperature

____Cement bond

____Other ____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical plant waste

B. Physical & chemical Description The waste consists of cuprous ammonium acetate, phenol, and caustic water.

C. Volume ____

IX. Preinjection waste treatment ____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	---	Sylvania	1000psi 210bpd
DST	---	"	1500psi 504bpd

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Date(s)	-----	Average	45gpm	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ___X___ bottom hole ________)

Date(s)		Average	1200psi	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: No problems or reasons for suspension of operation were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER BD-125 STATE Mc-10 UMR

I. Operating Company & General Well Location

Dow Chemical Company

Bay Refining Division

II. Well location (legal description)

Location: E 1/2, NE 1/4, SW 1/4, Sec. 10, T14N, R5E, Bay County, Michigan.

III. History: system planning, construction & operation.

Operation commenced during September 1959. This is the primary well used by Dow for waste disposal. Well Mc-9 is used as a standby for this well.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated near the center of the Michigan Basin. The regional dip is toward the west. There is a large regional anticline near the well.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 591 ft.) (Total well depth 4605 ft.)

Datum for depth measurement____________

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Same as Mc-9				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Sylvania	Devonian	4489		sandstone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:

6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	0ft.	98ft.	clay and gravel	
Saginaw	98ft.	326ft.	sandstone	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are some oil and gas pools and also coal found in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			10in.	905ft.	600 sacks
Intermed.					
Injection			7in.	4497ft.	1050 sacks
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

_X_ Drillers Log

____ Sample log

____ Drilling time

____ Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other____________________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical plant waste

B. Physical & chemical Description The waste fluid consists of phenol water, 20% spent caustic, and acidic water.

C. Volume ____________________

IX. Preinjection waste treatment Settling

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
4497-4695	8,000gal. acid	9-2-59
	16,000gal. acid	9-3-59

C. Injection rates and pressures

1. Rate

Date(s)		Average	45gpm	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole ______)

Date(s)	Aug. 1968	Average	1900psi	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: The well operates for 12 hours and is off for 12 hours.

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published Reference.

Michigan Water Resources Commission

Michigan Geological Survey

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER BD-105 STATE Mc-11 UMR

I. Operating Company & General Well Location

Ford Motor Company

Rouge Plant

Dearborn, Michigan

II. Well location (legal description)

Location: SE 1/4, NW 1/4, NW 1/4, Sec. 28, T2S, R11E, Wayne County, Michigan.

III. History; system planning, construction & operation.

The well was completed on March 1, 1956 and began operation during the same month.

When the well began operating a conflict arose between Solvay Process Division of Allied Chemical and Ford. Solvay filed an objection, stating that Ford's waste would possibly contaiminate nearby salt brine through "unsealed connections between the Sylvania and the salt brine cavity". The state geologist disagreed with Solvay and said there would be no problem.

The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southeast flank of the Michigan Basin. The regional dip is toward the northwest.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation________) (Total well depth 563 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
drift	Pleistocene	0ft.	80ft.	blue clay and gravel
Detroit River	Devonian	80ft.	400ft.	dolomite
Sylvania	Devonian	480ft.	120ft.	white sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Sylvania		482ft.		sandstone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift	20ft.	80ft.	clay & sand	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Salt is mined near the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.	9in.		7 in.	483ft.	95 sacks
Injection			2 in.	489ft.	

Other annulus filled with fresh water

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ______

VI. Description of surface equipment

A. Holding tanks & flow lines 30,000 gal. sump, 900 gal. surge tank

B. Filters leaf filters with diatomaceous earth and cartridge filter

C. Pumps Gardner Denver duplex reciprocating steam driven pump rated at 100 gpm at 450 psig.

D. Other ______

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other ____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste from the manufacture of coke (coke quench water)

B. Physical & chemical Description

270ppm cyanides

1300ppm phenol

300ppm H_2S

1579ppm ammonium thiocyanate

1900ppm sulfur

pH 8.9

C. Volume 50,000 gpd

IX. Preinjection waste treatment Filtration pH adjustment with 18° Be HCl

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
See operating problems		

C. Injection rates and pressures

1. Rate

Date(s)	Oct. 1956	Average	242gpm	Maximum	
	Nov. 1956	"	257gpm	"	
"	Dec. 1956	"	267gpm	"	
"		"		"	
"	average	"		"	

2. Pressure (well head X bottom hole)

Date(s)	Oct. 1956	Average	411psig	Maximum	
"	Nov. 1956	"	433psig	"	
"	Dec. 1956	"	399psig	"	
"		"			
"		"		"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Injection pressure increased in August 1957 and July 1959. Each time, the pressure was reduce by acidizing the injection interval.

In February, 1970, the 2in. tubing corroded and parted. It was removed and replaced with new tubing.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

Donaldson, 1964

WELL FILE NUMBER

No permit
STATE

Mc-12
UMR

I. Operating Company & General Well Location

Leonard Refineries, Inc.
Alma, Michigan

II. Well location (legal description)

Location: SW 1/4, SE 1/4, SE 1/4, Sec. 35, T12N, R3W, Pine River Township, Gratiot County, Michigan.

III. History; system planning, construction & operation.

The well was drilled and completed in June, 1957 by the McClure Oil Company. Operation began in June, 1957. The well is still in use.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated in the south-central portion of the Michigan Basin. The regional dip is toward the north.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 750 ft.) (Total well depth 1244 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
·ift	Pleistocene	0ft.	443ft.	clay and gravel
·ginaw-Parma	Pennsylvanian	443ft.	283ft.	cand and shale
·yport-Michigan	Mississippian	726ft.	374ft.	shale and dolomite
·rshall	Mississippian	1030ft.		sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
·rshall	Mississippian	1030ft.		sandstone

D. Engineering description of injection units

1. Porosity: ____
2. Permeability: ____
3. Original Reservoir Pressure: ____
4. Reservoir Temperature: ____
5. Chemical Character of Formation Water: ____
6. Reservoir Fracture Pressure: ____

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift		400ft.	clay and gravel	
Saginaw	443ft.	283ft.	sand and shale	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are several small oil accumulations in Gratiot County. There is also considerable coal in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			10 3/4in.	452ft.	265 sacks
Intermed.			7 in.	1025ft.	225 sacks
Injection					

Other annulus is filled with fresh water

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ________

VI. Description of surface equipment

A. Holding tanks & flow lines ________

B. Filters ________

C. Pumps ________

D. Other ________

VII. Cores, samples, & Logs

A. Coring

From ________ to ________ Recovery ________

" ________ ________ ________

" ________ ________ ________

" ________ ________ ________

" ________ ________ ________

" ________ ________ ________

B. Drilling Logs

___Drillers Log ___Drilling time

___Sample log ___Other: ________

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity

___SP

___Caliper

___Other

___Gamma ray-neutron

___Temperature

___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste effluent from a refinery operation.

B. Physical & chemical description The waste consists of foul condensate and spent caustic fluids

765 mg/l--[illegible]

7.7 mg/l--phenols

pH 8.8

Specific Gravity 1.002

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Static Pressure		Marshall	
			Pressure 221 to 780 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) _____ Average 50gpm Maximum 100gpm

2. Pressure (well head ✓ bottom hole _____)

Date(s) _____ Average 700 psi Maximum 950psi

X. Well operation & operating history

D. Description of operating programs: ______

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements ______

B. Monitoring requirements ______

C. Restrictions on operating procedure ______

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER ________ STATE   Mc-13 UNR

I. Operating Company & General Well Location

Holland Suco Color Company

subsidiary of Chemetron Corporation

Holland, Michigan Well #1

The plant and well are north of the city limits.

II. Well location (legal description)

Location: NE 1/4, NE 1/4, NW 1/4, Sec. 30, T5N, R15W,

Holland Township, Ottawa County, Michigan.

III. History, system planning, construction & operation.

The well began operation in 1966 and was reworked in 1969. The reworking consisted of replacing the tubing and packers with newer equipment.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated on the southeast margin of the Michigan Basin. The strata dip northeast toward the center of the state. Glacial lake deposits and drift cover the surface.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no X).

(Ground elevation________) (Total well depth 5895 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
rift	Pleistocene	0	460ft.	clay and gravel
arshall-Coldwater	Mississippian			sandstone and shale
raverse	Devonian			limestone
etroit River	Devonian			limestone and dolomite
alina	Silurian			evaporites
ichmond-Trenton	Ordovician			limestone and shale
t. Peter	Ordovician			sandstone and dolomite
rempealeau	Cambrian			dolomite

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
unising	Cambrian	4608ft.	1300ft.	sandstone
ranconia	Cambrian			sandstone
resbach	Cambrian			sandstone
Eau Claire	Cambrian			sandstone
t. Simon	Cambrian			sandstone

D. Engineering description of injection units

1. Porosity: average 15%
2. Permeability: variable
3. Original Reservoir Pressure: ____
4. Reservoir Temperature: ____
5. Chemical Character of Formation Water: ____
6. Reservoir Fracture Pressure: ____

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift			clay and sand	
Marshall			sandstone	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are several oil and gas accumulations in the vicinity of the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	13 5/8in.	H-40 32.75lb/ft.	10 3/4in.	538ft.	350 sacks
Intermed.	8 3/4in.	J-55 23 lb/ft.	7 in.	4606ft.	1375 sacks
Injection		6.5lb/ft.	2 7/8in.	4600ft.	

Other

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

20 Centralizers on 7in. casing

Otis packer at 4606ft.

VI. Description of surface equipment

A. Holding tanks & flow lines 2 large settling tanks

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

	From	to	Recovery
From	4824ft.	4848ft.	
"	5300ft.	5334ft.	
"	5516ft.	5576ft.	
"			
"			
"			

B. Drilling Logs

___ Drillers Log

X Sample log

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity

___ SP

_X_ Caliper

___ Other ______

_X_ Gamma ray-neutron

___ Temperature

_X_ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Effluent from a pigment manufacturing process.

B. Physical & chemical Description Pickle liquor of dilute sulfuric acid 2 to 30% solution

C. Volume 500 gal./hr.

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones Tested	Description of test results
4 Drill Stem Tests			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
All Zones	Acidization	6000 gal. HCl

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
February 1968	135gpm	

2. Pressure (well head X bottom hole ________)

Date(s)	Average	Maximum
	125psi	190 psi

X. Well operation & operating history

D. Description of operating programs: ______________________

____

E. Operating problems: Well was reworked in 1969, and tubing and packer were replaced.

____

XI. Regulatory aspects.

A. Construction requirements ______________________

____

B. Monitoring requirements ______________________

____

C. Restrictions on operating procedure ______________________

____

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

Winar, R. M.

Civil Engineering, May 1966

WELL FILE NUMBER

STATE: ____ UWN: Mc-14

I. Operating Company & General Well Location

Chemetron Corporation

Pigments Division

Holland, Michigan

Well #2

II. Well location (legal description)

Location: SW 1/4, NE 1/4, NW 1/4, Sec. 30, T5N, R14W,

Holland Township, Ottawa County, Michigan

300ft. south of the first well

III. History, system planning, construction & operation.

The well was drilled in July 1969 and is presently on a standby status for Chemetron's first well at the pigment plant.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated on the southeast margin of the Michigan Basin. The strata dip northeast toward the center of the state. Glacial lake depoits cover the land surface.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation 620 ft.) (Total well depth 5910 ft.)

Datum for depth measurement ____________________

Name	Age	Depth (top)	Thickness	Lithologic Description
Same as Mc-17				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Same as Mc-17				

D. Engineering description of injection units

1. Porosity: ____________________
2. Permeability: ____________________
3. Original Reservoir Pressure: ____________________
4. Reservoir Temperature. ____________________
5. Chemical Character of Formation Water: ____________________
6. Reservoir Fracture Pressure: ____________________

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift				
Marshall				

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are several oil and gas accumulations in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	15 in.		10 3/4in.	535ft.	325 sacks
Intermed.	8 3/4in.		7 in.	4730ft.	880 sacks
Injection					
Other					

Describe bottom hole completion method: perforated completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

7 Centralizers on the 10 3/4 in. casing

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From ________ to ________ Recovery ________

"

"

"

"

"

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

_X_ Caliper ____Cement bond

_X_ Other C F D

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Effluent from a pigment manufacturing process

B. Physical & chemical Description 55% Water, 0-15% H_2SO_4, 0-15% HCl, 0-15% $(NH_4)_2SO_4$, 0-10% NH_4, Specific gravity 1.000 to 1.125, pH 1.0 to 9.0

C. Volume 200,000 gpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	4 hours	4678 to 5072ft.	recovered 2000ft. of salt water

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) ______ Average 200gpm Maximum 300gpm

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

2. Pressure (well head ______ bottom hole ______)

Date(s) ______ Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

X. Well operation & operating history

D. Description of operating programs: ______

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements ______

B. Monitoring requirements ______

C. Restrictions on operating procedure ______

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Geological Survey

WELL FILE NUMBER   STATE   Mc-15 / UNK

I. **Operating Company & General Well Location**

Wyandotte Chemical Company

Wyandotte, Michigan

II. **Well location (legal description)**

Location: Section 23, T[illegible]2N, R2W, Wayne County, Michigan

III. **History; system planning, construction & operation.**

The well began operating in October 1966. The system was abandoned in August, [illegible]. It was connected in series with Mc-19, therefore, waste fluids were pumped simultaneously to both wells. Records of data are for the combined system. The waste was injected into an abandoned salt cavity in the Salina Formation.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** The regional dip is toward the north west. The well is on the southeast flank of the Michigan Basin.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ___; no X).

(Ground elevation ________) (Total well depth 1400 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
drift	Pleistocene	0ft.	60ft.	clay and gravel
Detroit River	Devonian	60ft.	115ft.	dolomite and anhydrite
Sylvania	Devonian	165ft.	115ft.	sandstone and dolomite
Bois Blank	Devonian	280ft.	30ft.	dolomite and chert
Bass Island	Silurian	310ft.	415ft.	dolomite, shale, and anhydrite
Salina	Silurian	850ft.		evaporites

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Salina	Silurian	850ft.		evaporites

D. Engineering description of injection units

1. Porosity: ________
2. Permeability: ________
3. Original Reservoir Pressure: ________
4. Reservoir Temperature: ________
5. Chemical Character of Formation Water: ________
6. Reservoir Fracture Pressure: ________

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
drift		60ft.	sand and gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are no mineral resources reported in the area of the injection well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From ________ to ________ Recovery ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other ____________________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical process water

B. Physical & chemical Description The waste contains 3% solids (calcium sulfate solids) Specific Gavity 1.17

C. Volume ____________________

IX. Preinjection waste treatment ____________________

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)		Average	375gpm	Maximum	1075gpm
"		"		"	into two wells
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole)

Date(s)		Average	Gravity	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: ____________________

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements ____________________

B. Monitoring requirements ____________________

C. Restrictions on operating procedure ____________________

XII. Economics

A. Total and unit costs of construction ______________________

B. Operating costs ______________________

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER ______ STATE   Mc-16 UMR

I. **Operating Company & General Well Location**

Wyandotte Chemical Company

Wyandotte, Michigan

II. **Well location (legal description)**

Location: Section 23, T12N, R2W, Wayne County, Michigan.

III. **History; system planning, construction & operation.**

The well began operating in October 1966. The system was abandoned in August, 1968. It was connected in series with Mc-18, therefore, waste fluids were pumped simultaneously to both wells. Records of data are for the combined system. The waste was injected into an abandoned salt cavity and migrates into the Salina Formation.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** The regional dip is toward the northwest. The well is situated on the southeast flank of the Michigan Basin.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation________) (Total well depth 1400ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Same as Mc-18				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Salina	Silurian	850ft.		evaporites

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift			sand and gravel	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are no mineral resources reported in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From ______	to ______	Recovery	______
" ______	______		______
" ______	______		______
" ______	______		______
" ______	______		______
" ______	______		______
" ______	______		______

B. Drilling Logs

____Driller's Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity
____SP
____Caliper
____Other____
____Gamma ray-neutron
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical process water

B. Physical & chemical Description Same as Mc-18

C. Volume ____

IX. Preinjection waste treatment ____

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. [illegible]

[illegible]				
[illegible]	Average	375gpm	Maximum	1075gpm
	"		"	into two wells
"	"		"	
"	"		"	
"	"		"	

2. [illegible] X bottom hole)

[illegible]	Average	Gravity	Maximum	
"	"		"	
	"		"	
	"		"	
	"		"	

X. Well operation & operating history

D. Description of operating programs: ______________________

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements ______________________

B. Monitoring requirements ______________________

C. Restrictions on operating procedure ______________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER ______ STATE ______ Mc-17 UMR

I. Operating Company & General Well Location

Blunk Laundromat

1111 Round Lake Road

Union Lake, Michigan

II. Well location (legal description)

Location: SW 1/4, NE 1/4, SE 1/4, Sec. 35, T3N, R8E, White Lake Township, Oakland County, Michigan.

III. History; system planning, construction & operation.

Blunk originally utilized a lagoon for waste disposal, but the permit for this lagoon was suspended due to local water well pollution.

The disposal well was drilled and completed during March, 1967 and began operating during the same month. This well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated on the southeast flank of the Michigan Basin. The regional dip is to the northwest. The Howell Anticline is west of the well.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included--yes____; no X).
(Ground elevation________) (Total well depth 1840ft.)
Datum for depth measurement________

Name	Age	Depth (top)	Thickness	Lithologic Description
drift	Pleistocene	0ft.		
Sudbury	Mississippian	576ft.	29ft.	shale
Berea	Mississippian	605ft.	59ft.	sandstone & silt
Bedford	Mississippian	664ft.	202ft.	shale
Antrim	Devonian	866ft.	143ft.	shale
Traverse	Devonian	1009ft.	289ft.	shale & limestone
Dundee	Devonian	1298ft.	139ft.	limestone
Detroit River	Devonian	1437ft.	263ft.	anhydrite & dolomite
~~Sylvania~~	~~Devonian~~	~~1774ft.~~		~~sandstone & dolomite~~

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Sylvania	Devonian	1774ft.		sandstone

D. Engineering description of injection units

1. Porosity:________
2. Permeability:________
3. Original Reservoir Pressure:________
4. Reservoir Temperature:________
5. Chemical Character of Formation Water: 466,000ppm total dissolved solids, sp. gravity 1.19, pH 5.8, Ca 36,400 ppm, Mg 8,900 ppm, Na 59,000 ppm, K 3,000 ppm.
6. Reservoir Fracture Pressure:________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Coldwater	300ft.	15ft.	shale	fresh water
Berea	608ft.	60ft.	sandstone	fresh water

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the area of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	12 1/4in.	J-55	24lb/ft.	8 5/8in.	283ft.	175 sacks
Intermed.	7 7/8in.	J-55	20lb/ft.	7 in.	832ft.	175 sacks
	6 1/4in.	J-55	15.5lb/ft.	5 1/2in.	1361ft.	
Injection	4 3/4in.			2 in.		

Other

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ___________

VI. Description of surface equipment

A. Holding tanks & flow lines 3 compartment - cement block settling tank

B. Filters ___________

C. Pumps ___________

D. Other ___________

VII. Cores, samples, & Logs

A. Coring

From ______	to ______	Recovery ______
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ___________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other ____

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Laundromat waste water

B. Physical & chemical Description

C. Volume 8000 gpd

IX. Preinjection waste treatment Filtration and sedimentation

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection	---	open hole	before acidization - 17gpm
Injection	---	open hole	after acidization - 126gpm

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1361 to 1820ft.	acidization	1000 gal.

C. Injection rates and pressures

1. Rate

Date(s) ________ Average 5.5gpm Maximum ________

2. Pressure (well head X bottom hole ________)

Date(s) ________ Average Gavity Maximum ________

. Well operation & operating history

D. Description of operating programs: ______________________

E. Operating problems: No problems were reported.

I. Regulatory aspects.

A. Construction requirements ______________________

B. Monitoring requirements ______________________

C. Restrictions on operating procedure ______________________

XII. Economics

A. Total and unit costs of construction $20,000.00

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER

STATE

Mc-18
UMR

I. Operating Company & General Well Location

Michigan Chemical Corporation

St. Louis, Michigan

II. Well location (legal description)

Location: NW 1/4, NW 1/4, NE 1/4, Sec. 23, T12N, R2W, Gratiot County, Michigan.

III. History, system planning, construction & operation.

The well began operating in May, 1967 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located just south of the center of the Michigan Basin. The regional dip is to the north.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no x).

(Ground elevation________) (Total well depth 3762ft.)

Datum for depth measurement________

Name	Age	Depth (top)	Thickness	Lithologic Description
Marshall	Mississippian			sandstone
Coldwater	Mississippian			shale
Antrim	Devonian			shale
Traverse	Devonian			cherty limestone
Dundee	Devonian			dolomite

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Dundee	Devonian	3422		dolomite and limestone

D. Engineering description of injection units

1. Porosity:________
2. Permeability:________
3. Original Reservoir Pressure:________
4. Reservoir Temperature:________
5. Chemical Character of Formation Water: Sp. gr. 1.2, NaCl 143,000 ppm, $CaCl_2$ 89,000 ppm, $MgCl_2$ 2,300 ppm.
6. Reservoir Fracture Pressure:________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Marshall			sandstone	fresh water for municiple use

F. Mineral Resources (oil and gas, coal, brines, etc.)

Coal bearing Pennsylvanian strata are located in the area of the disposal well. Small oil and gas pools are also found in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	17 1/2in.	H-40	46lb/ft.	13 3/8in.	704ft.	525 cu. ft.
Intermed.	11 in.	J-55	36lb/ft.	8 5/8in.	3421ft.	580 cu. ft. 50/50 Lite Poz.
Injection				3/4in.		
Other						

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other ____________________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste Effluent from the processing of natural brines.

B. Physical & chemical Description Calcium Chloride Brine

C. Volume

IX. Preinjection waste treatment Sedimentation and filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Date(s)		Average	140gpm	Maximum	200gpm
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ____X____ bottom hole ________)

Date(s)		Average	Gravity	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: ______________________

E. Operating problems: There were originally some problems in the injection operation. These problems were alleviated by acidization.

XI. Regulatory aspects.

A. Construction requirements ______________________

B. Monitoring requirements ______________________

C. Restrictions on operating procedure ______________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER

STATE

Mc-19

UMR

I. Operating Company & General Well Location

Semet-Solvay Division

Allied Chemical Company

II. Well location (legal description)

Location: Wayne County, Michigan

III. History, system planning, construction & operation.

The well was drilled and completed in June 1969 and began operating soon after completion. It is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southwestern flank of the Michigan Basin and southeast of the Howell Anticline. The regional dip in the area is to the northeast.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 600 ft.) (Total well depth 4112 ft.)

Datum for depth measurement Kelly Bushing

Name	Age	Depth (top)	Thickness	Lithologic Description
drift	Pleistocene		104ft.	clay and gravel
Dundee	Devonian	104ft.	66ft.	limestone
Detroit River	Devonian	170ft.	378ft.	limestone
Sylvania	Devonian	548ft.	72ft.	sandstone
Bass Island	Silurian	620ft.	360ft.	dolomite
Salina	Silurian	980ft.	1320ft.	anhydrite, halite, dolomite, and gypsum

Continued on page 2a

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	4040ft.		sandstone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes___; no___).

(Ground elevation________) (Total well depth__________)

Datum for depth measurement__________

Name	Age	Depth (top)	Thickness	Lithologic Description
Niagaran Series	Silurian			cherty limestone
Cincinnatian	Ordovician	2300ft.	590ft.	limestone and shale
Trenton	Ordovician	2910ft.	630ft.	limestone
Eau Claire	Cambrian	3815ft.	250ft.	sandstone
Mt. Simon	Cambrian	[illegible]		sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution

D. Engineering description of injection units

1. Porosity: __________
2. Permeability: __________
3. Original Reservoir Pressure: __________
4. Reservoir Temperature: __________
5. Chemical Character of Formation Water: __________
6. Reservoir Fracture Pressure: __________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift		104ft.	clay, sand, & gravel	
Sylvania	548ft.	72ft.	sandstone	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are a few small oil and gas pools west of the disposal site.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	17 1/2in.	H-40	48lb/ft.	13 3/8in.	121ft.	131 sacks
Intermed.		J-55	24lb/ft.	8 5/8in.	1774ft.	545 sacks
		J-55	14lb/ft.	5 in.	3764ft.	
Injection		J-55	6.5lb/ft.	2 1/2in.	4106ft.	

Other

Describe bottom hole completion method: Perforated completion 3754 ft. to 4106 ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ________

Baker Model "A" packer at 3720 ft.

VI. Description of surface equipment

A. Holding tanks & flow lines ________

B. Filters ________

C. Pumps ________

D. Other ________

VII. Cores, samples, & Logs

A. Coring

From ________ to ________ Recovery ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________
" ________ ________ ________

B. Drilling Logs

____ Drillers Log

_X_ Sample log

____ Drilling time

____ Other: ________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

_X_SP

_X_Caliper

_X_Other Lateralog, Compensating formation density log

_X_Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste effluent from the manufacture of metallurgical coke and by-product chemicals

B. Physical & chemical Description pH 9.8

2000mg/1 Cl

3450mg/1 Total solids

3350mg/1 TDS

9500ppm Ammonia

1000ppm phenol

Specific Gravity 1.01

Viscosity at 20°C 1.12cp

C. Volume 100 - 150,000 gpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
DST	---	perforated zone	195psig
Injection	---	" "	1 1/2bpm at 400psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Mt. Simon	Acidization	5,000 gal.
Mt. Simon	Buffer injection	8,400 gal. fresh water

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ______ bottom hole ______)

Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Iron in the glauconite and pyrite in the formation reacted with the waste fluid and formed a black precipitate. The well was shut down until chemists could make the waste effluent compatible with the formation fluid. This problem was finally corrected by buffer injection. This problem cost $5,000. Tubing failed twice due to poor installation. It was replaced with the same type of tubing.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Geological Survey

WELL FILE NUMBER ______ STATE   Mc-20 UMR

I. Operating Company & General Well Location

Glaser Crandell Company

Mattawan, Michigan

II. Well location (legal description)

Location: NW 1/4, SE 1/4, NW 1/4, Sec. 13, T3S, R13W, Antwerp Township, Van Buren County, Michigan.

III. History; system planning, construction & operation.

The well was drilled and completed in May, 1958 by the Muskegon Development Company. The well began operating soon after completion and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the southwest flank of the Michigan Basin. There is a large regional anticline approximately 25 miles north of the site. The regional dip in the vicinity of the well is to the northeast.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 682 ft.) (Total well depth 1660 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
drift	Pleistocene	0ft.	300ft.	clay and gravel
Coldwater	Mississippian	303ft.	792ft.	shale
Antrim	Devonian	1095ft.	111ft.	shale
Traverse	Devonian	1206ft.	237ft.	cherty limestone
Detroit River	Devonian	1443ft.		limestone

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Detroit River	Devonian	1443ft.		limestone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
drift		300ft.	gravel & sand	

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are several large oil and gas accumulations in the vicinity of the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			10 1/2in.	362ft.	225 sacks
Intermed.					
Injection			7 in.	1651ft.	426 cu. ft.
Other					

Describe bottom hole completion method: perforated completion 6 holes from 1627 to 1630 ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From ________ to ________ Recovery ________

" ________ ________ ________

" ________ ________ ________

" ________ ________ ________

" ________ ________ ________

" ________ ________ ________

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other ________________________________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste from the production of pickles and relishes

B. Physical & chemical Description ________________

C. Volume 55 to 80,000 gpd

IX. Preinjection waste treatment ________________

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1651 to 1773ft.	Acidization	1000 gal. Super X 28% HCl
" "	"	" " " " " "

C. Injection rates and pressures

1. Rate

Date(s)	before acid	Average	6gpm	Maximum	
	after acid	'	126gpm	"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole)

Date(s)	before acid	Average	1280psi	Maximum	
"	after acid	"	320psi	"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: ______

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements ______

B. Monitoring requirements ______

C. Restrictions on operating procedure ______

XII. Economics

A. Total and unit costs of construction ______________

B. Operating costs ______________

XIII. Source(s) of Information and Published References ______________

Michigan Geological Survey

WELL FILE NUMBER

STATE:

UMR: Mc-21

I. Operating Company & General Well Location

Dow Chemical Company

Midland, Michigan

II. Well location (legal description)

Not known

III. History, system planning, construction & operation.

The well began operating in April, 1960 and is used as a stand-by well.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated near the center of the Michigan Basin. The regional dip is to the northeast. A large anticlinal structure is located approximately 10 miles west of the well.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation________) (Total well depth 3740 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Marshall	Mississippian	~1200ft.		sandstone
Dundee	Devonian	3580ft.		limestone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Dundee	Devonian	3580ft.		limestone

the waste is injected into numerous 1ft. to 5ft. zones in the Dundee

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. **Geology & Geohydrology, continued**

E. **Geohydrology; fresh water aquifers in vicinity**

Name	Depth	Thickness	Character	Chemical Quality
Saginaw	340ft.	90ft.	sandstone	
Parma	795ft.	80ft.	sandstone	
Marshall	1180ft.	120ft.	sandstone	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Highly saline brines are pumped from Devonian age rocks and used as a source for chemical products.

V. **Well design and construction**

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			10 3/4in.	1266	
Intermed.			7 in.	3545	up to 1300ft.
Injection					

Other annulus filled with fresh water

Describe bottom hole completion method: perforated completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines 2 holding basins

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	____	to	____	Recovery ____
"	____		____	____
"	____		____	____
"	____		____	____
"	____		____	____
"	____		____	____

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity
____SP
____Caliper
____Other ____________________

____Gamma ray-neutron
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Waste from oil refinery and salt mining operations.

B. Physical & chemical Description Organic waste with phenol, brine, propylene oxide, methyl cellulose, and organic wash water.

C. Volume ____________________

IX. Preinjection waste treatment Settling, pH control

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)		Average	No record	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ______ bottom hole ______)

Date(s)		Average	No record	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: ____________________

E. Operating problems: ____________________

XI. Regulatory aspects.

A. Construction requirements ____________________

B. Monitoring requirements ____________________

C. Restrictions on operating procedure ____________________

XII. Economics

A. Total and unit costs of construction ______

B. Operating costs ______

XIII. Source(s) of Information and Published References ______

Michigan Water Resources Commission

Michigan Geological Survey

Donaldson 1964

WELL FILE NUMBER

STATE

Mc-22
UMN

I. Operating Company & General Well Location

Dow Chemical Company

Midland, Michigan

II. Well location (legal description)

Location: SW 1/4, NW 1/4, SW 1/4, Sec. 21, T14N, R2E, Midland County, Michigan.

III. History, system planning, construction & operation.

The well was originally drilled in 1945 as a brine disposal well. In 1949, the long string parted and the well was abandoned. In June, 1960 the well was reworked and the defective casing was replaced. The well became operational as a phenol disposal well in 1967 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Same as Mc-21

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 606 ft.) (Total well depth 4299 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Same as Mo-21				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Dundee	Devonian	3645ft.	230ft.	limestone

The waste is injected into numerous 1ft. to 5ft. zones in the Dundee.

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Saginaw	240	90ft.	sandstone	
Parma	795	80ft.	sandstone	
Marshall	1180	120ft.	sandstone	

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			14 in.	164ft.	
Intermed.			8 5/8in.	1398ft.	
			7 in.	3983ft.	
Injection					
Other					

Describe bottom hole completion method:

V. **Well design and construction, continued**

B. Packers, Centralizers, well head equipment, etc: ______

VI. **Description of surface equipment**

A. Holding tanks & flow lines 2 holding tanks

B. Filters ______

C. Pumps ______

D. Other ______

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other____________________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Oil refinery and brine processing

B. Physical & chemical Description Organic wastes consisting of phenol, propylene oxide, methyl cellulose, and wash water, and spent brines.

C. Volume ____________________

IX. Preinjection waste treatment ____________________

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Date(s)	Oct. 1969	Average	175gpm	Maximum	
"	Nov. 1969	"	201gpm	"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole ______)

Date(s)		Average		Maximum	
Date(s)	Oct. 1969	Average	560psi	Maximum	
"	Nov. 1969	"	630psi	"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: ______

E. Operating problems: The only reported operating problem occurred in 1949 when the casing of the "brine well" parted.

XI. Regulatory aspects.

A. Construction requirements ______

B. Monitoring requirements ______

C. Restrictions on operating procedure ______

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER ______ STATE   Mc-23 UMR

I. **Operating Company & General Well Location**

Dow Chemical Company

Midland, Michigan

II. **Well location (legal description)**

Location: SE 1/4, SW 1/4, NE 1/4, Sec. 27, T14S, R2E, Midland County, Michigan

III. **History; system planning, construction & operation.**

The well was drilled in 1951 and began operating during May, 1960. It is still in operation.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** Same as Mc-21

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation________) (Total well depth 5150 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Same as Mc-				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Sylvania	Devonian	4925ft.		sandstone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Same as Mc-21				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Same as Mc-21

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		40#/ft.	10 3/4in.	1308ft.	650 sacks
Intermed.		20#/ft.	7 in.	4898ft.	600 sacks
Injection tubing			15 1/2in.	4926ft.	

Other annulus is filled with fresh water

Describe bottom hole completion method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ______
Hook wall packer at 4822ft. on 5 1/2in. tubing.

VI. Description of surface equipment

A. Holding tanks & flow lines 2 holding tanks

B. Filters ______

C. Pumps ______

D. Other ______

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other ____________________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Oil refining and salt mining

B. Physical & chemical Description Same as Mc-21

C. Volume ____________________

IX. Preinjection waste treatment Sedimentation and pH control

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
4925 to 5112ft.	Acidization	10,000 gal. - 20% HCl

C. Injection rates and pressures

1. Rate

Date(s)	Oct. 1969	Average	241gpm	Maximum	
"	Nov. 1969	"	276gpm	"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole)

Date(s)	Oct. 1969	Average	770psi	Maximum	
"	Nov. 1969	"	670psi	"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: The 5 1/2 in. tubing corroded and was replaced in Nov. 1966.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Geological Survey

Michigan Water Resources Commission

WELL FILE NUMBER BD-49 STATE Mc-24 UMR

I. Operating Company & General Well Location

Dow Chemical Company

Midland, Michigan

II. Well location (legal description)

Location: Sec. 22, T14N, R2E, Midland County, Michigan

III. History; system planning, construction & operation.

The well was put into operation in June, 1964, and is still in use.

IV. Geology & Geohydrology

A. Regional geologic setting: Same as Mc-21

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation________) (Total well depth 3,984 ?)

Datum for depth measurement Ground level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Same as Mc-21				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Dundee	Devonian	3915		limestone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Same as Mc-21				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Same as Mc-21

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			11 3/8"	1388	
Intermed.			8 5/8"	3740?	
Injection tubing			3 3/8"	3915	

Other annulus filled with fresh water

Describe bottom hole completion method: Open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ______

VI. Description of surface equipment

A. Holding tanks & flow lines ______

B. Filters ___screens___

C. Pumps ______

D. Other ______

VII. Cores, samples, & Logs

A. Coring

From	3844	to	3850	Recovery	
"	3866		3894		
"	3905		3938		
"					
"					
"					

B. Drilling Logs

___Drillers Log ___Drilling time

___Sample log ___Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

____ Resistivity
____ SP
____ Caliper
____ Other ____________________
____ Gamma ray-neutron
____ Temperature
____ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical plant

B. Physical & chemical Description Activated sludge from waste treatment - contains 3% organic solids. Also spent brines and plant waste waters.

C. Volume ____________________

IX. Preinjection waste treatment settling and screening

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
3829 to 3945	acidization	10,000 gal. HCl

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
	60gpm	

2. Pressure (well head ______ bottom hole ______)

Date(s)	Average	Maximum
	1725 to	2850psi

X. Well operation & operating history

D. Description of operating programs: ____________________

E. Operating problems: ____________________

XI. Regulatory aspects.

A. Construction requirements ____________________

B. Monitoring requirements ____________________

C. Restrictions on operating procedure ____________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Water Resources Commission

Michigan Geological Survey

WELL FILE NUMBER [illegible] [illegible] [illegible]

UNK

I. Operating Company & General Well Location

Dow Chemical Company

Midland, Michigan

II. Well location (legal description)

Location: NW 1/4, SW 1/4, NW 1/4, Sec. [illegible], T14N, R2E, Midland Township, Midland County, Michigan.

III. History, system planning, construction & operation.

The well was drilled in January, [illegible] as a salt well. It was abandoned and plugged with 200 sacks of cement during May, 195[illegible]. In [illegible], 1966, this well was reworked as a disposal well and is presently on a standby status.

IV. Geology & Geohydrology

A. Regional geologic setting: Same as Mc-21

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes___; no X).

(Ground elevation________) (Total well depth 4269 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Same as Mc-21				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Dundee	Devonian	3912ft.	48ft.	limestone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature.
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Saginaw	410ft.	85ft.	sandstone	usable fresh water
Parma	517ft.	64ft.	sandstone	" " "
Marshall	1160ft.	44ft.	sandstone	

F. Mineral Resources (oil and gas, coal, brines, etc.)

Same as Mo-21

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		24lb/ft.	8 5/8in.	1515ft.	
Intermed.		20lb/ft.	7 in.	2290ft.	300 sacks
Injection		15.5lb/ft.	5 1/2in.	3761ft.	
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Packer at 3063 ft.

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity	___Gamma ray-neutron
___SP	___Temperature
___Caliper	___Cement bond
___Other______	

VIII. Waste Characteristics

A. Industrial process from which waste is derived

Same as Mc-21

B. Physical & chemical Description Same as Mc-21

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)__________ Average________ Maximum________

" __________ " ________ " ________

" __________ " ________ " ________

" __________ " ________ " ________

" __________ " ________ " ________

2. Pressure (well head ________ bottom hole ________)

Date(s)__________ Average________ Maximum________

" __________ " ________ " ________

" __________ " ________ " ________

" __________ " ________ " ________

" __________ " ________ " ________

X. Well operation & operating history

D. Description of operating programs: ____________________

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements ____________________

B. Monitoring requirements ____________________

C. Restrictions on operating procedure ____________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Geological Survey

WELL FILE NUMBER

STATE | Mc-26
UNR

I. Operating Company & General Well Location

Dow Chemical Company

Midland, Michigan

II. Well location (legal description)

Location: NW 1/4, SW 1/4, SW 1/4, Sec. 22, T14N, R2E,
Midland Township, Midland County, Michigan.

III. History, system planning, construction & operation.

The well was drilled in June, 1969, and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Same as Mc-21

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes____; no X).

(Ground elevation [illegible] ft.) (Total well depth 5160 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Same as Mc-21				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Sylvania	Devonian		108ft.	sandstone

D. Engineering description of injection units

1. Porosity: 16 - 17%
2. Permeability: 100 md - to air
3. Original Reservoir Pressure: 1265 psi
4. Reservoir Temperature.
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Same as Mc-21				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Same as Mc-21

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	15 "	H-40 40.5lb/ft.	10 3/4in.	1390ft.	750 sacks
Intermed.	9 3/4"	J-55 23 lb/ft.	7 in.	4970ft.	
Injection		J-55 12.75lb/ft.	4 1/2in.	4970ft.	

Other annulus is filled with noncorrosive fluids

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ______

Packer at 4960 ft.

4 Centralizers on 7 in. string

Continuous rate - pressure recorders on well head

VI. Description of surface equipment

A. Holding tanks & flow lines ______

B. Filters ______

C. Pumps ______

D. Other ______

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other ____________________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as Mc-21

B. Physical & chemical Description Same as Mc-21

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)		Average	300gpm	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole)

Date(s)		Average	700psi	Maximum	800psi
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Geological Survey

WELL FILE NUMBER Mc-27 UMR

I. **Operating Company & General Well Location**

Dow Chemical Company

Midland, Michigan

II. **Well location (legal description)**

The well is located in the SE 1/4, SE 1/4, NE 1/4, Section 26, T14N, R2E, Midland Township, Midland County, Michigan.

III. **History; system planning, construction & operation.**

The well was drilled by the Scott Drilling Company of Clare, Michigan. The well was completed in 1960 and is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Same as Mc-21

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes___; no X).

(Ground elevation 643 ft.) (Total well depth 5182 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Marshall	Mississippian	1220ft.		sandstone
Dundee	Devonian	3830ft.		limestone
Sylvania	Devonian	4922ft.		sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Sylvania	Devonian	4922ft.		sandstone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Same as Mc-21				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Same as Mc-21

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface		28 lblft.	8 5/8in.	1351ft.	535 sacks
Intermed.		14 lb/ft.	5 1/2in.	4810ft.	450 sacks
Injection			4 1/2in.	4924ft.	

Other Annulus filled with water containing sodium dichromate

Describe bottom hole completion method: In May, 1960, the 5 1/2inch casing was perforated at 3338 to 3340ft. and cemented to the surface with 800 cubic feet of 50/50 Lite Poz. #3

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

A Baker model "A" packer was installed at 4729 ft.

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other ____________________

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Same as Me-21

B. Physical & chemical Description Same as Me-21

C. Volume 300,000 gpd

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Sylvania Formation	Acidization	10,000 gal. of 20% HCl

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
	Oct. 1969		98gpm		
"	Nov. 1969	"	120gpm	"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ______ bottom hole ______)

Date(s)		Average		Maximum	
	Oct. 1969		770psi		
"	Nov. 1969	"	630psi	"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: On Oct. 30, 1969, the annular pressure rose due to a leak in the 4 1/2in. casing. The well was shut down on that date. On Nov. 12, the 4 1/2in. tubing was pulled and the leak was found in the third joint from the well head. A new string of 3 1/2in. tubing was installed to replace the 4 1/2in. The tubing consisted of; 32 ft. of 4 1/2in., 9.5 lb/ft. N-80 and 4696 ft. of 3 1/2in., 9.3lb/ft. EVE, J-55 tubing. The well was placed back in operation on Nov. 15, 1969.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Michigan Geological Survey

WELL FILE NUMBER ______ STATE ______ Nv-1 UMR

I. Operating Company & General Well Location

Cliffs Copper Corp.
Rio Tinto Mine
near Mountain City, Nevada

II. Well location (legal description)

Location: Sec. 11, T45N, R53E, Elko County, Nevada

III. History, system planning, construction & operation.

A permit was issued and the well drilled April 1971. The well was scheduled to begin operation in June 1972.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located in the northern portion of the basin and range physiographic and geologic province. Sedimentary and igneous volcanic rocks are present with slightly metamorphosed Ordovician sediments being the oldest and Recent alluvial deposits the youngest. The structure of the area is complex, with the Roberts thrust fault occuring in the subsurface.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no__X__).

(Ground elevation__________) (Total well depth 6,697 ±)

Datum for depth measurement________________

Name	Age	Depth (top)	Thick-ness	Lithologic Description
	Recent			alluvium
	Tertiary			volcanic tuffs and intrusives
	Upper Cretaceous			intrusive igneous rocks
	Carboniferous ?			siltstone, limestone, greenstone
	Mississippian			limestone, conglomerate, intrusives and flows
	Devonian or Miss.			conglomerate w/siltstone and slate
1. Valmy Fm.	Ordovician			chert, slate, limestone, quartzite

C. Geologic Description of injection units & possible units, not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Valmy Fm.	Ordovician	3,400-4,100		principally quartzite with some limestone

D. Engineering description of injection units

1. Porosity: Fracture porosity
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

1. The general section encountered in the area is listed. The column for the well was not obtained.

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

Copper is mined at the Rio Tinto Mine from the black and gray phyllite and quartzite of the Ordovician age Valmy Formation. Mine workings extend to at least 1,000 feet below the surface.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From ________ to ________ Recovery ________

" ________ ________ ________

" ________ ________ ________

" ________ ________ ________

" ________ ________ ________

" ________ ________ ________

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other_____________________________

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Solution mining of copper

B. Physical & chemical Description Iron sulfate solution remaining after leaching of copper with sulfuric acid and plating out copper metal.

C. Volume anticipated 500 gpm for 10 years

IX. Preinjection waste treatment Removal of iron

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures - not yet operated

1. Rate

Date(s) ______________ Average ______________ Maximum ______________

" ______________ " ______________ " ______________

" ______________ " ______________ " ______________

" ______________ " ______________ " ______________

" ______________ " ______________ " ______________

2. Pressure (well head ______________ bottom hole ______________)

Date(s) ______________ Average ______________ Maximum ______________

" ______________ " ______________ " ______________

" ______________ " ______________ " ______________

" ______________ " ______________ " ______________

" ______________ " ______________ " ______________

X. Well operation & operating history

D. Description of operating programs: ____________________

E. Operating problems: It was found that if iron was not removed before injection, the injection horizon would plug.

XI. Regulatory aspects.

A. Construction requirements ____________________

B. Monitoring requirements ____________________

C. Restrictions on operating procedure ____________________

XII. Economics

A. Total and unit costs of construction ______

B. Operating costs ______

XIII. Source(s) of Information and Published References ______

Neveda Bureau of Environmental Health

WELL FILE NUMBER STATE NM-1 UMR

I. Operating Company & General Well Location

The Anaconda Company

Grants, New Mexico

II. Well location (legal description)

Location: 10 miles west of Grants, New Mexico

III. History; system planning, construction & operation.

The Anaconda Company processes uranium ore by leaching with sulfuric acid, followed by ion exchange to recover the uranium.

The well was drilled to a total depth of 2,511 feet to the granite basement. It was then plugged back to 1,830 feet and completed in sandstone of the Permian Yeso Formation.

Injection operations were initiated December 14, 1960.

The primary objective of the disposal well was to maintain a tailings pond at a minimum practical size. This objective has been reported to be successful.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is on the extreme southeast edge of the San Juan basin. The stratigraphic section consists of Triassic and Permian sandstone, limestone, dolomite, and shale.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes X ; no ____).

(Ground elevation _________) (Total well depth 2,511 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Chinle	Triassic	0ft.	350ft.	limestone and shale
San Andres	Permian	350ft.	200ft.	sandstone and limestone
Yeso	Permian	550ft.	1000ft.	sandstone and interbedded shale
Abo	Permian	1550ft.	700ft.	sandstone and shale

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Yeso Fm.	Permian	950ft.	563ft.	sandstone and interbedded shale

D. Engineering description of injection units

1. Porosity: Average of 16.5% in sandstones
2. Permeability: Average of 105 millidarcies
3. Original Reservoir Pressure: ________
4. Reservoir Temperature: ________
5. Chemical Character of Formation Water: 414ppm Na, 157ppm Mg, 592ppm Ca, 17.5ppm Fe, 304ppm Cl, 2,270ppm SO_4, total dissolved solids 4,060ppm, pH 7.3 from a swab sample taken at 1305-1450 feet.
6. Reservoir Fracture Pressure: ________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
San Andres	360ft.	200ft.	limestone & dolomite	adequate for municipal, industrial, & agricultural use.

F. Mineral Resources (oil and gas, coal, brines, etc.)

The well is associated with uranium mining in the immediate vicinity.

V. **Well design and construction**

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17 in.		13 3/8in.	730ft.	surface
Intermed.	11 i-.		8 5/8in.	1830ft.	
		316 SS	6 5/8in.	900ft.	
Injection					
Other					

Describe bottom hole completion method: perforated completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines All surface equipment is lined with rubber or constructed of 316 steel.
300 gal. surge tank and 1.4 miles of 12in. rubber lined pipe.

B. Filters Screen filter and 2 leaf filters

C. Pumps 2 - 316 steel sump pumps

D. Other 25,000 square yard tailings pond

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery	2,066ft.
"			
"			
"			
"			
"			

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

X SP

___ Caliper

___ Other ___

___ Gamma ray-neutron

X Temperature

___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Treatment of sandstone uranium ores by sulfuric acid leach and ion-exchange recovery.

B. Physical & chemical Description Mildly acidic solution which contains large amounts of Mg, Fe, and sulfate and chlo-ide salts. It also contains small concentrations of Uranium-natural, Thorium - 230, and Radium - 226.

C. Volume ___

IX. Preinjection waste treatment The liquid is decanted of solids, treated with 4ppm copper sulfate and 10ppm polyphosphate and filter-d to 0.1ppm-turbidity.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Drill stem		injection zone	
Pump test		injection zone	

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Date(s)		Average	400gpm	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ______ bottom hole ______)

Date(s)		Average		Maximum	
Date(s)		Average	negligible	Maximum	
"		"	numerical value	"	
"		"	not reported	"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: A fresh water monitoring well, 300 ft. from the disposal well, is in constant use. Also regional water sampling is done.

E. Operating problems: Cleaning and reworking the well damaged the liner and produced zones where it was severely attacked by corrosion. The plastic tubing was removed and replaced with a liner made of 316 steel.

Fungus was plugging the delivery pipe. The fungus was destroyed with formaldehyde.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements 3 springs, 3 ponds, and several municipal wells are analyzed bimonthly.

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction $562,000.

B. Operating costs

XIII. Source(s) of Information and Published References

Arlin, Z. E., 1962, Deep-well disposal of Uranium tailing Water, in Proc. 2nd Conf. on Ground Disposal of Radioactive Wastes, Chalk River, Canada, Sept. 26-29, 1961, U. S. Atomic Energy Commission TID-7628, Block 2, p. 356-360, Donaldson, 1964; Written communication The Anaconda Company.

I. Operating Company & General Well Location

International Salt Company on site of Watkins Glen Refinery in Schuyler County, Reading Township, New York.

II. Well Location (legal description)

Watkins 15-minute Quadrangle, Section D.

Longitude 76°52'16"

Latitude 42°24'[illegible]"

III. History, system planning, construction & operation.

April 1, 1969 Permit to construct a waste disposal system was issued by the Industrial Facility Section of the New York State Department of Health to be completed for operation by June 1, 1970.

Three existing salt mining wells 4, 7A and 7 will be used for the salt water disposal. The salt water will be pumped into well 4, and will be hydraulically forced out of 7A. Any undissolved salts will settle in the cavity between wells 4 and 7A at 1340' below sea level (depth 1700') and with a volume of 6.5×10^7 cubic feet. The liquid effluent from well 7A will be pumped into well 7 where the liquid will pass into the Black Water horizon in the Marcellus shale 800' below sea level (1260' depth).

November 3, 1971 Permit for operation was issued

December 3, 1971 Started operation

Note: Once disposal well becomes operational, the supervision comes under the Industrial Work Section of the New York State Department of Environmental Conservation. Contact Mr. Willard Bruce or Anthony Adamczyk, Area code 518-457-6634 or 6609.

IV. Geology & Geohydrology

A. Regional geologic setting: The sedimentary rocks consist of Upper, Middle, Lower Devonian and Upper Silurian, Salina group down to the Salt cavity is the Syracuse salt formation (Upper Silurian Age). The beds dip south at approximately 50 to 60 feet/mile.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no_X__).

(Ground elevation 459') (Total well depth 1710' plugged back t[illegible] 1344')

Datum for depth measurement ______

Name	Age	Depth (top)	Thickness	Lithologic Description
Genesee shales	Devonian	33'	205' Est.	Shales
Tully Limestone	Devonian	239'	27'	Limestone
Hamilton shales	Devonian	266'	874' Est.	Shales and siltstones
Marcellus shales	Devonian	1140'	300'	Shale and limestone
Onondaga Limestone	Devonian	1440'	40' Est.	Limestone

Silurian Age

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Marcellus	Devonian	1260'-1315' Est.	55' Est.	In this area the shales appear to be highly fractured and jointed as they lost drilling mud in drilling through the Marcellus shales.

D. Engineering description of injection units

1. Porosity: no data
2. Permeability: no data
3. Original Reservoir Pressure: no data
4. Reservoir Temperature: no data
5. Chemical Character of Formation Water: Sulfurous water
   This water "Black Water" is essentially an impure but saturated brine.
   Water samples taken in general area. Specific Gravity 1.2[illegible]
   PH 6.0
6. Reservoir Fracture Pressure: In drilling through Marcellus shales, they lost drilling mud probably due to fractured shales.

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]'	[illegible]
[illegible]	[illegible]'	[illegible]'	Shale with an interbedded limestone (Cherry Valley)
Onondaga	[illegible]'	40'	Limestone

[illegible] in the [illegible] horizon [illegible] heavily mineralized and not potable.

D. Mineral Resources (oil and gas, coal, brines, etc.)

[illegible] - [illegible] gas storage field [illegible] 6 miles [illegible] of the disposal area.

Texas Eastern [illegible] storage area in salt cavern is approximately [illegible]' north of the disposal area.

[illegible] brine fields are approximately [illegible] south of the disposal area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Type Casing or Tubing: Weight & Grade	Size	Depth Set	Type & Amount of Cement
Surface		Wrought Iron	10 3/4"	70'	
Intermed.		Wrought Iron	5 1/2"	1085'	
Injection					
Other					

Describe bottom hole completion method: Open hole.

[illegible] completion, etc. [illegible]

A. Packers, centralizers, well head equipment, etc: Well head [illegible]

[illegible] 5½" [illegible]

[illegible] packer at base of 5½" casing

VII. Description of surface equipment

A. Holding tanks & flow lines Collection system consisting of a collection tank, diameter 8', 7½' deep, a collection tank mixer with 1/3 H.P. motor. Collection tank to well 4 has 2 pumps, each 160 GPM @ 90'.

B. Valves

C. Pumps Well 4 has 2 pumps, each 160 GPM @ 90', head 46 PSI Maximum.
Well 7A to well 7 - 2 submersible pumps each 160 GPM @ 290',
head 125 PSI Maximum.

D. Other Well 4 - 1 flow meter and 1 pressure recorder.
Well 7A to well 7 - 1 flow meter and 1 pressure recorder.

VIII. Cores, samples, & logs Old salt well converted to waste disposal

A. Coring None

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

X Drillers log ____ Drilling time

____ Sample log ____ Other: ____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other________________________________

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Refining of salt from brine wells using evaporation process.

B. Physical & chemical Description Brine water that consists of NaCl, $CaCO_3$, Cl_2, $CaSO_4$, Na_2SO_4.

The solubility of NaCl in water at 60°F is approximately 35[illegible],000 mg/l.

C. Volume 160 GPM Maximum

Average 80 GPM

Present rate 50-60 GPM

IX. Preinjection waste treatment The solid waste is left in the salt cavity and the brine leaves the cavity via well 7A and then injected into well 7 to be disposed in the Marcellus shale.

[illegible]

B. Treatments or Stimulation: None

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) [illegible] Average 20 gpm Maximum 100 gpm

2. Pressure (Well head 300 PSI Bottom hole)

Date(s) Average Maximum 300 psi

II. [illegible] operating history

D. Illustration of operating history: Started injection [illegible] 1970; [illegible] 1971 [illegible] injection well head pressure 100 psi then dropped to 55-60 psi.

January, 1972 [illegible] well head pressure 60 psi; flow 60-65 gals/min.

February, 1972 [illegible] well head pressure 55 psi; flow 45-50 gals/min.

E. Operating problems:

III. Regulatory aspects.

A. Construction requirements Casing must be sealed from formation from surface to disposal zone.

B. Monitoring requirements 5 observation wells required into the lowest fresh water zone, (tested every 2 weeks). The pressure in the space outside the casing is monitored for pressure to detect leak in casing.

C. Restrictions on operating procedure If salinity of observation wells increases, injection well must be shut down until cause is found.

[illegible]

[illegible] Estimated [illegible]

B. Operating Costs

III. Source(s) of Information and Published References

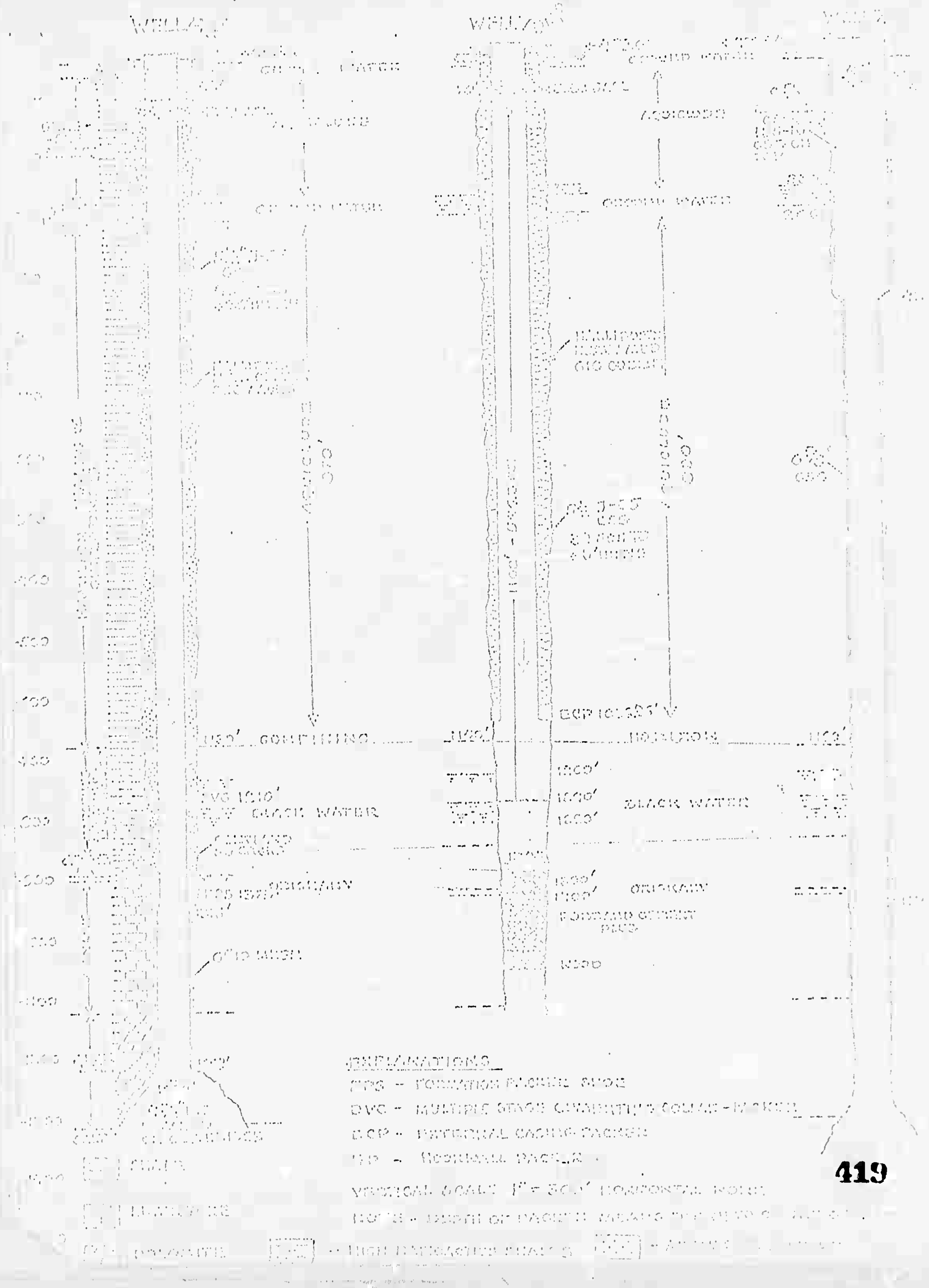
[illegible] for construction of [illegible] facilities at International Salt [illegible]

[illegible] Watkins Glen, New York.

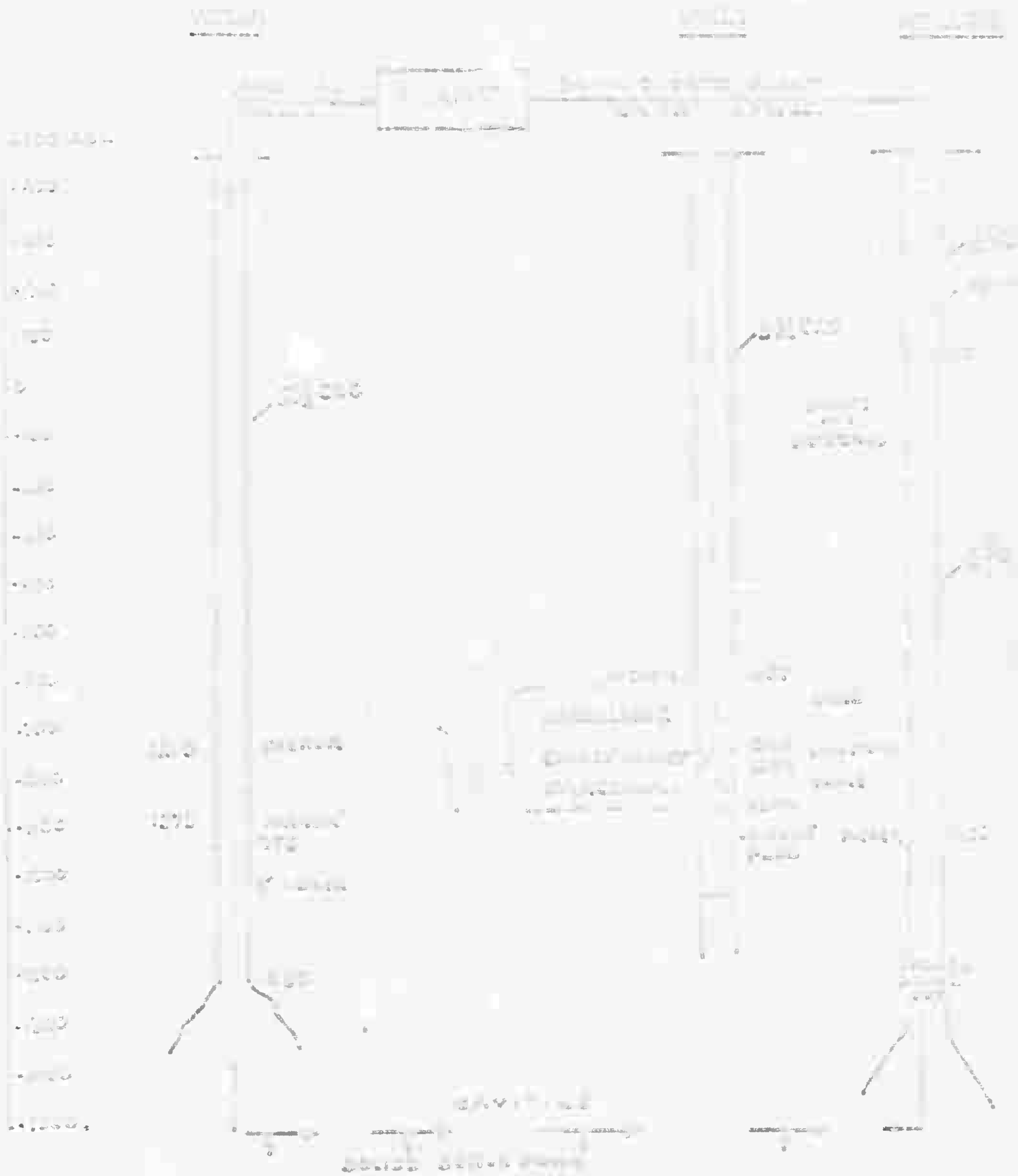
[illegible] on this project.

[illegible], 1971 - [illegible] on the industrial waste disposal facilities [illegible]

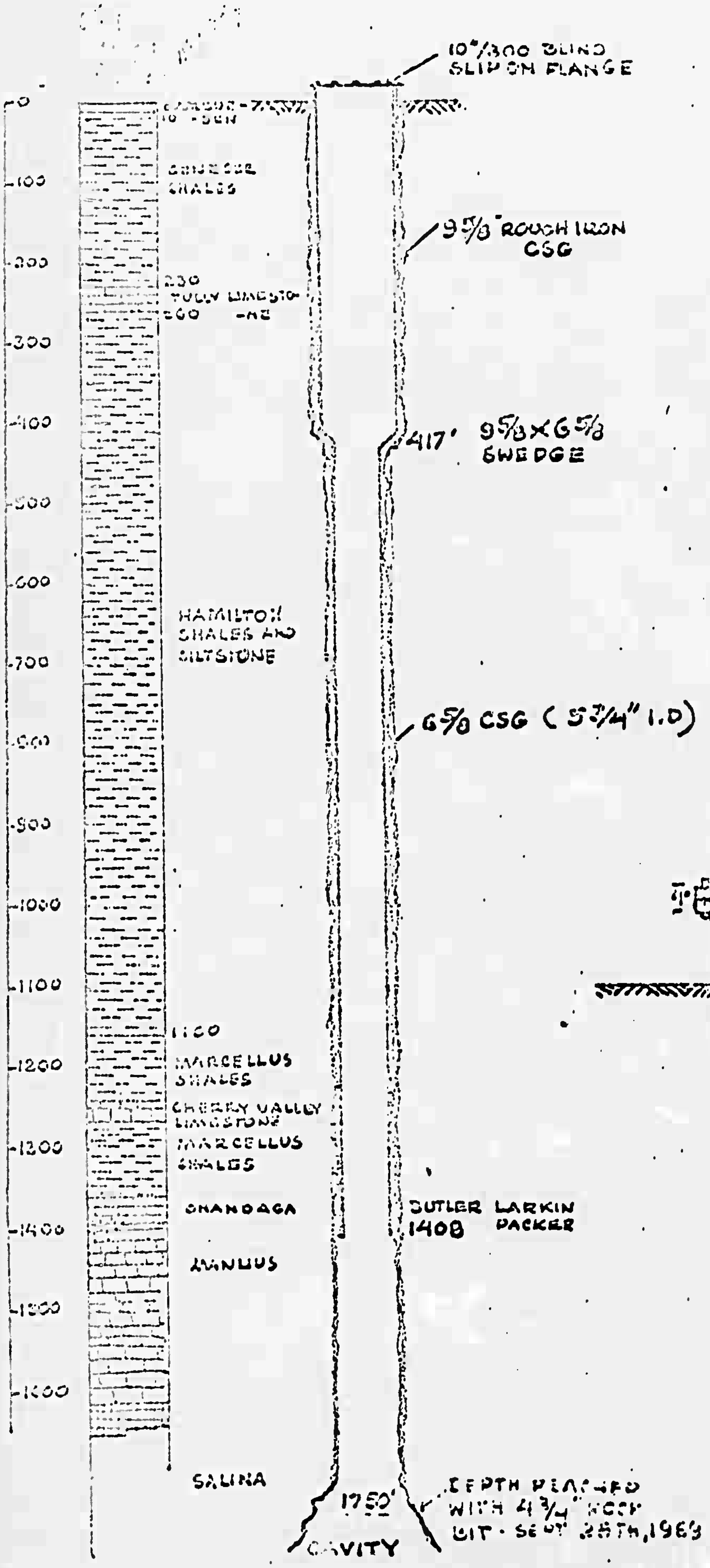
[illegible] at International Salt Company, Watkins Glen, New York


BLACK WATER
ORDINARY
EXPLANATIONS

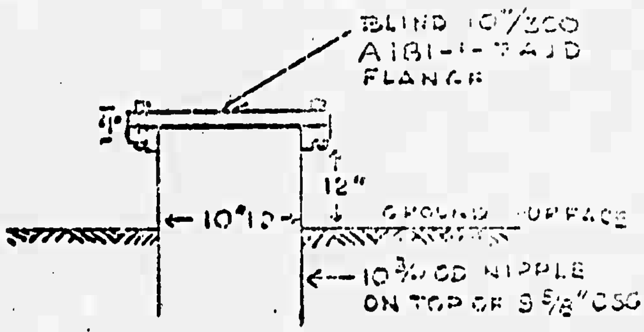
GENERAL DIAGRAM OF THE WASTE DISPOSAL OPERATION



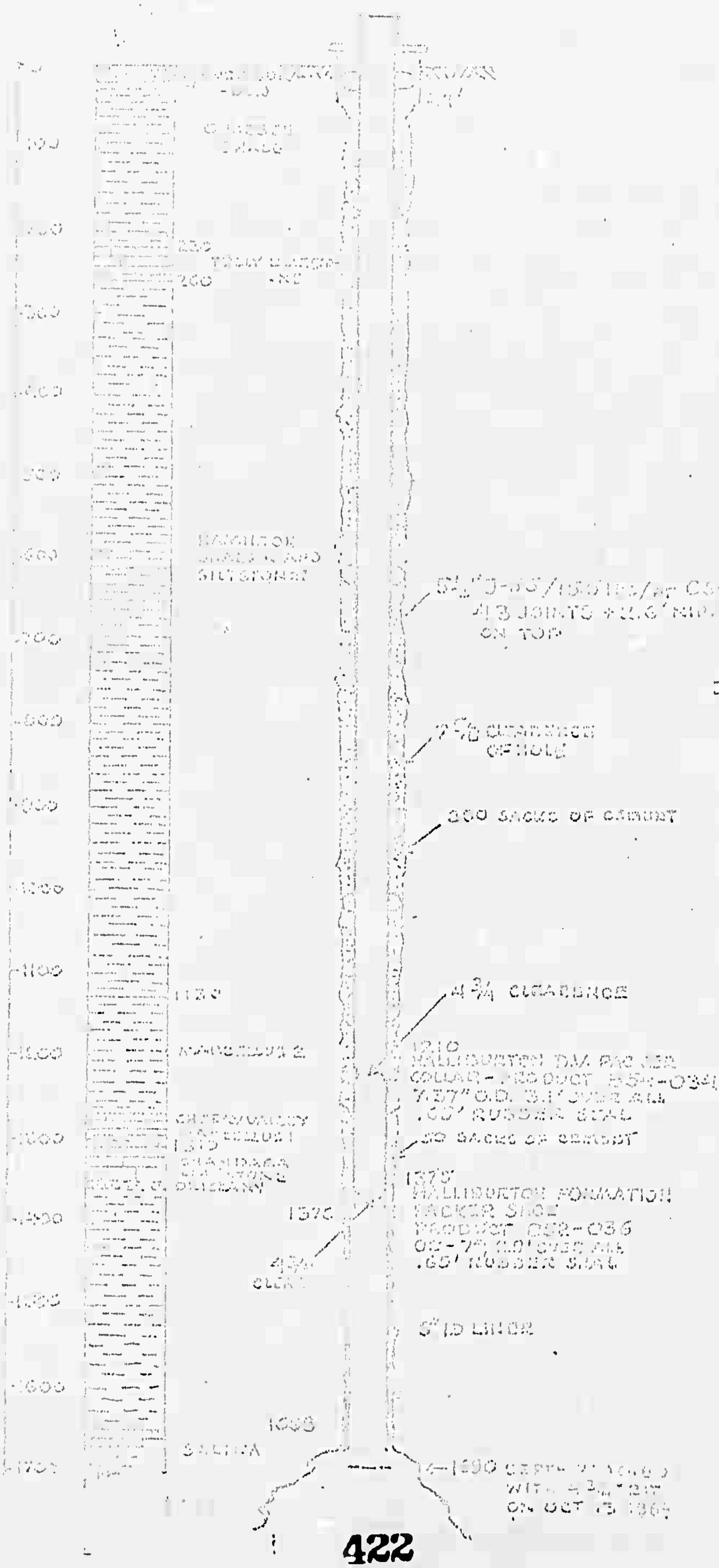
WELL 7A – RECONDITIONED SEPT 27–29, 1969

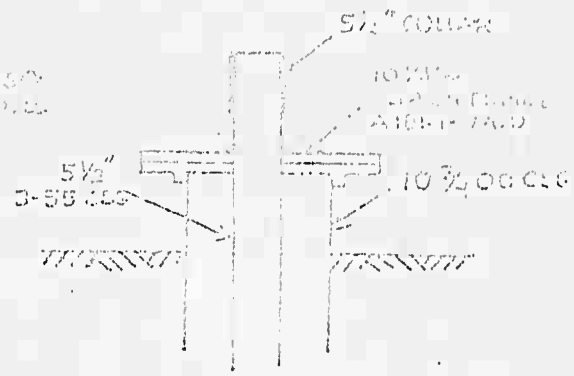


ESCAPE OF EXCESS OF FLUID – SUBMERSIBLE PUMP



- RECONDITIONED OCT 4 - OCT 13TH, 1969

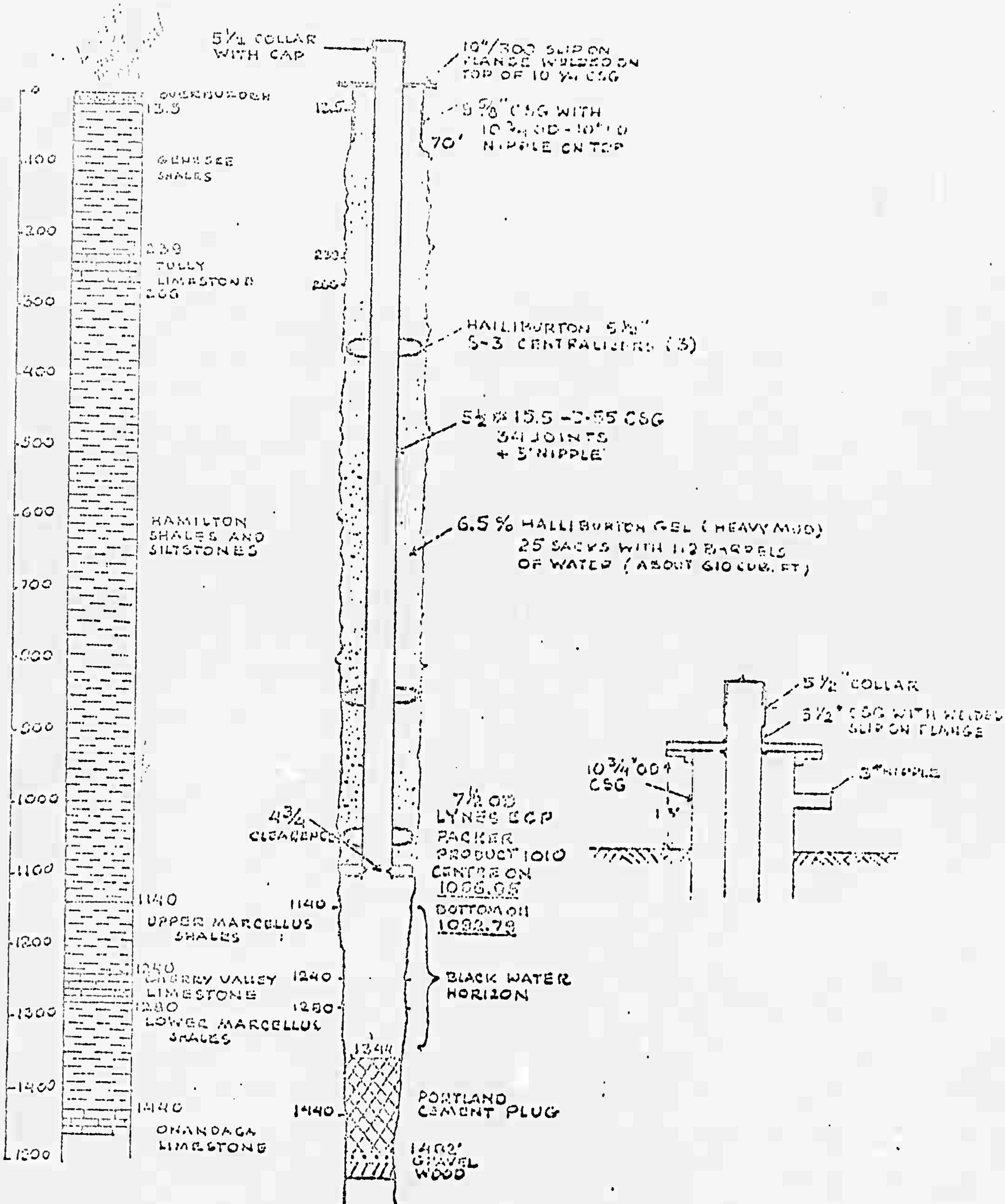




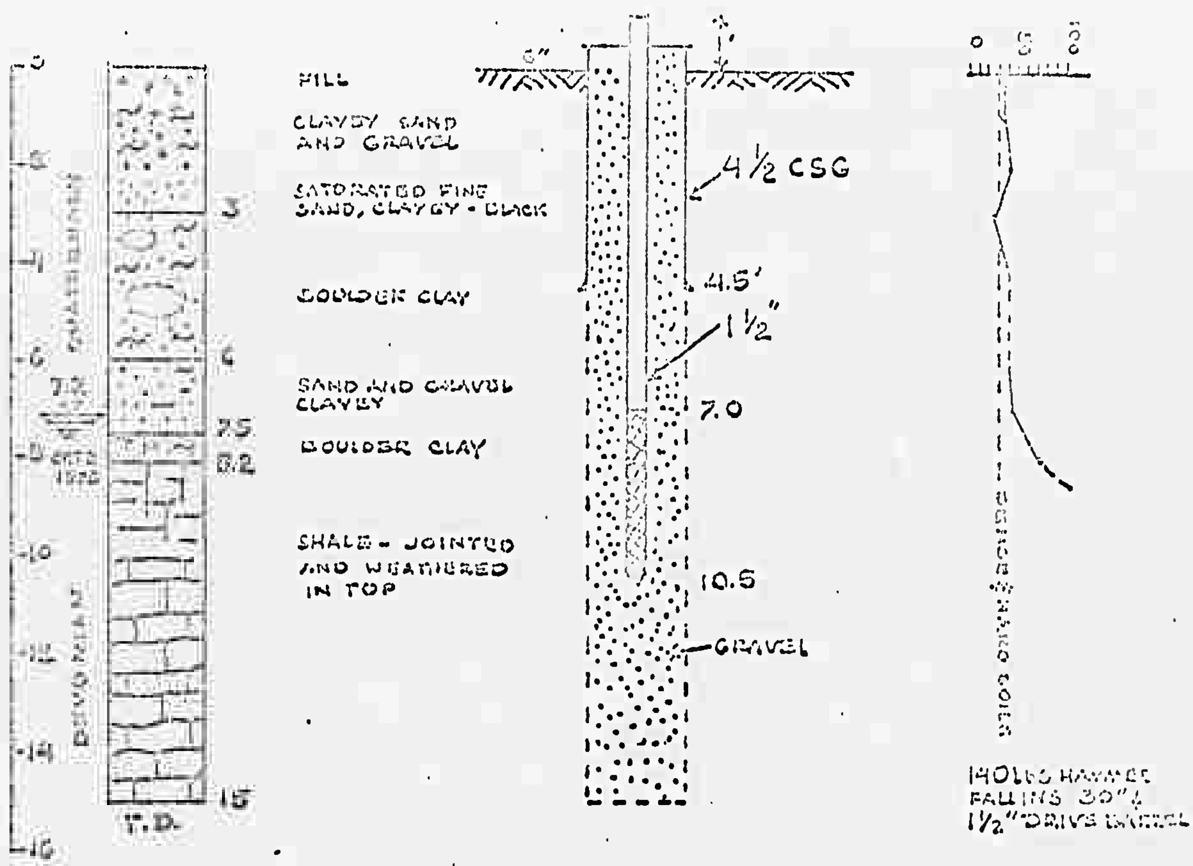
NOTE WATER OUTSIDE 5½" CSG WAS REPLACED WITH 6% GEL BEFORE 1 STAGE OF CEMENTATION WAS PERFORMED. 0.25 LBS/SACK FLOCELE WAS ADDED TO BOTH STAGES. ADDITIONALLY 2% OF $CaCl_2$ BY WEIGHT WAS ADDED TO THE 1 STAGE CEMENT

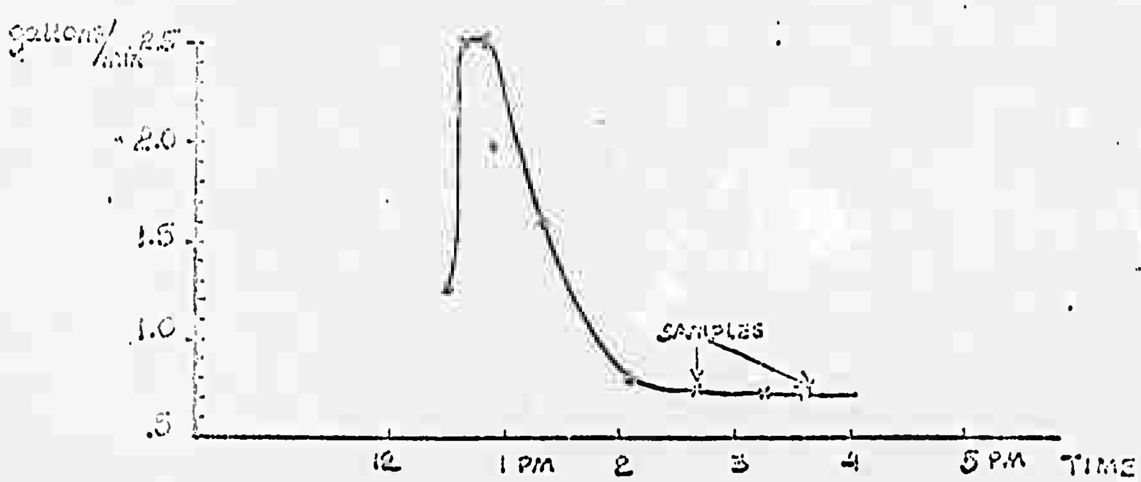
DATUM GROUND SURFACE

WELL 7 - RECONDITIONED SEPT 30 - OCT 7, 1969

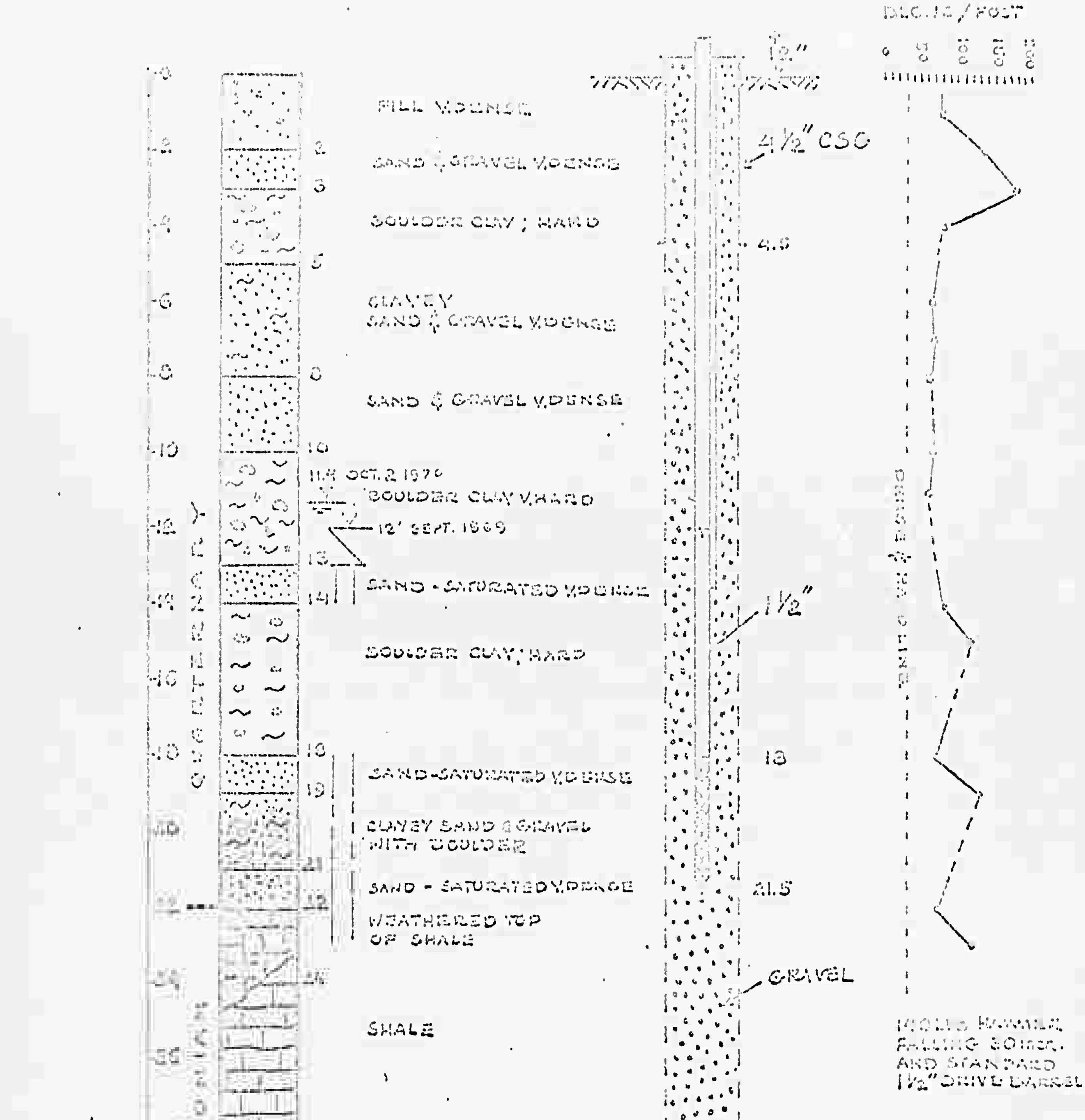


OBSERVATION WELL NO 1





OBSERVATION WELL NO 2



I. [illegible] Company & General Well Location

Hooker Chemical Corporation ([illegible]), situated at Hooker Chemical Corporation, Niagara Falls plant; City of Niagara Falls, Niagara County, New York.

II. Well Location (Legal Description)

Niagara Falls [illegible] quadrangle, Section I

Latitude 1000' south of 43°05'

Longitude 1550' east of 79°00'

III. History, system planning, construction & operation.

8/11/68 Application to drill was issued by the Bureau of Mineral Resources of the New York State Department of Environmental Conservation.

[illegible]/68 Well spudded in. 9/5/68 Well completed. The Cambrian section [illegible] section between [illegible].

9/[illegible]/68 through 9/18/68 water injection test were run on the disposal formations (Cambrian [illegible]).

9/30/69 Permit to construct a disposal well was issued by the Industrial Facility Section of the New York State Department of Health to be completed and in operation in full by 12/31/70.*

Permit to operate was not issued as company was able to sell their excess HCl waste. Well shut in.

*Note: Industrial Facility Section is now located in Department of Environmental Conservation.

Consulting Firms: American Industrial Disposal Systems, Inc. (AIDS); Benedum-Trees Building; Pittsburgh, Penn. 15222; Phone (412) [illegible]

Deep Well Pollution Control Corporation; Box 326; Worthington, Ohio 43085; Phone (614) [illegible]

IV. Geology & Geohydrology

A. Regional geologic setting: The sedimentary rocks consist of Middle and Lower Silurian, Ordovician and Cambrian overlying the Metamorphic basement complex. The beds dip to the south approximately 25 to 30' per mile near the surface and increase to approximately 90'/mile on the basement complex. There appears to be little if any significant structural deformation in the general area of the well.

C. Lithologic Description of Injection Units [illegible]

Rock Unit

		Depth (feet)	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

D. Engineering Description of Injection Units

1. Porosity: [illegible]
2. Permeability: [illegible]
3. Original Reservoir Pressure: [illegible]
4. Reservoir Temperature: [illegible]
5. Chemical Character of Formation Fluids: [illegible]
6. Reservoir Fracture Pressure: [illegible]

[illegible] a natural fracture system capable of transmitting fluids [illegible] at moderate threshold pressures.

IV. [illegible] 5.

E. [illegible]

[illegible]

F. Mineral Resources (oil and gas, coal, brines, etc.)

[illegible]

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Type Casing or Tubing: Weight & Grade	O. D. Size	Depth Set	Type & Amount of Cement
Surface	[illegible]		[illegible]	[illegible]	[illegible]
Intermediate	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Long String	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]					
		[illegible]	[illegible]	[illegible]	[illegible]
Injection			[illegible]		

Other: [illegible]

Describe bottom hole completion method: [illegible]

Open hole.

VI. Well design and construction, continued

E. Packers, Centralizers, well head equipment, etc:

[illegible] casing [illegible] accessories [illegible]

[illegible] joint and centralizer on top of [illegible] joint.

[illegible] guide shoe on bottom of [illegible] joint, [illegible]

[illegible] bottom, metal petal baskets placed on [illegible] joints [illegible] displacement plug, and [illegible] centralizers [illegible] on the casing.

VII. Description of surface equipment

A. Holding tanks & flow lines [illegible]

B. Filters

C. Pumps

D. Other

VIII. Cores, samples, & Logs

A. Coring

From	to	Recovery
2848'	2868'2"	[illegible]
2868'2"	2871'2"	[illegible]
2896'	2922'	[illegible]
2939'	2966'	[illegible]
2966'	2987'	[illegible]
2987'	3014'	[illegible]
3014'	3030'	[illegible]
3030'	3041'	[illegible]

B. Drilling Logs

x Drillers Log

x Sample log

Drilling time

Other:

[illegible]. Well operation & operating histo[illegible]

A. Tests

[illegible]	Duration	Zones Tested	Description of Test Results
[illegible]	10 days Sept 9 thru Sept. 19, 1968	Theresa-Dresbach 2835-3026	1,973,300 gallons of [illegible] injected in a ten-day test program. All water was filtered [illegible] a five-foot anthracite filter & treated with a biocide concentration of 10 to 15 ppm before [illegible] injected into the well.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Theresa-Dresbach	15% and 25% HCl acid	Prior to pilot water injection the Cambrian section was acidized to clean the open hole formation. A total of 12,[illegible] gals of HCl acid was used in the treatment; the acid was probably inhibited & contained a surfactant.

C. Injection rates and pressures (Testing)

1. Rate

Date(s)		Average		Maximum
September 9, 1968		50		50
" September 11, 1968	"	75	"	100
" September 13, 1968	"	250	"	500
" September 15, 1968	"	100	"	250
" September 19, 1968	"	95	"	255

2. Pressure (well head ______ bottom hole ______)

Date(s)		Average		Maximum
September 9, 1968		625*		625*
" September 11, 1968	"	1168*	"	1264
" September 13, 1968	"	1420	"	1650*
" September 15, 1968	"	1193	"	1430*
" September 19, 1968	"	1510*	"	1510*

* Stabilized

XII. Economics

A. Total and unit costs of construction Installation of the Disposal (1968) well $233,000+

B. Operating costs

XIII. Source(s) of Information and Published References

1. 11/1/67-AIDS Feasibility Report
2. 10/9/68-AIDS Part II - Waste Disposal Test Well - WDL #1A
3. 12/27/68-Hooker Part I - Proposed Disposal Program using Deep Well Injection
4. 1/28/69-Deep Well Pollution Control Corp.- Evaluation of the Drilling, Testing Completion of Hooker Corp. W.L.D. No
5. 3/3/69-Deep Well Pollution Control Corp.-Hooker Chemical Corp. W.L.D. No. 1-A
6. Numerous conferences between state agencies and representatives of Hooker Chemical Corp. with their consultants.
7. New York State Geological Survey; Education Dept., Education Bldg, Albany, NY. New York State Department of Environmental Conservation, Industrial Facility Section and Bureau of Mineral Resources.

WELL FILE NUMBER

New York Well File
STATE Number 6668

NY-3
UMR

B

I. Operating Company & General Well Location

Bethlehem Steel Corporation (WLD NO. 1-A)

Situated at Bethlehem Steel Corporation, Lackawanna plant; Hamburg Township, Erie County, New York.

II. Well location (legal description)

Buffalo 15-minute quadrangle, Section H

Latitude North 42°48'11"

Longitude West 78°50'40"

III. History; system planning, construction & operation.

4/18/68 Application to drill was issued by The Bureau of Mineral Resources of the New York State Environmental Conservation Department.

4/17/68 Well spudded in; 5/12/68 Well completed.

5/15/68 Pilot water injection commenced; completed 5/27/68.

Prior to Pilot water injection the Cambrian Section was acidized to clean open-hole bore section between 3800 feet to 4300 feet.

9/30/69 Permit to construct a disposal well - issued by the Industrial Facility Section of the New York State Department of Health.

Note: Industrial Facility Section is now in the New York State Department of Environmental Conservation.

Permit to operation - not issued as of February 9, 1972.

Consultant Firm: American Industrial Disposal Systems, Inc. (AIDS)
Benedum-Trees Building
Pittsburgh, Pennsylvania 15222

IV. Geology & Geohydrology

A. Regional geologic setting: The sedimentary rocks consist of the Middle and Lower Devonian, Silurian, Ordovician and Cambrian overlying the Metamorphic basement complex. The beds dip to the south approximately 30'/mile near the surface and increase to approximately 90'/mile on basement complex. There appears to be little if any significant structural deformation in the general area of the well.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____no____).

(Ground elevation 583') (Total well depth 4313')

Datum for depth measurement Birdwell Logging - Geological Log

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Lorraine-Utica	Ordovician	2247	747	Shale
Trenton	Ordovician	2994	596	Limestone
Black River	Ordovician	3590	204	Limestone
Theresa	Cambrian	3794	337	Dolomite & Sandstone
Potsdam	Cambrian	4131	120	Sandstone
Basement Complex		4251		Metamorphozed biotitic granite

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Theresa	Cambrian	3794	337	Most sedimentary area of New Yor
Potsdam	Cambrian	4131	120	Most sedimentary area of New Yor

D. Engineering description of injection units

Specific Gravity 1.22

Fluid Level Stabilized @ 380'

1. Porosity: Average 5%
2. Permeability: 113 milidarcies
3. Original Reservoir Pressure: 1938 psig @ 4000'

Formation water @ 3818'

Final Fmtn. Water @ 4300'

Water @ 4300' less saturated with brine than that @ 3818'

4. Reservoir Temperature: 77°F
5. Chemical Character of Formation Water:

   Chlorides 203,838 ppm Specific Gravity 1.22 @ 77°F

   Sodium chloride 336,332 ppm Viscosity 1.045 centepoise @ 60°F

   Calcium carbonate 30,837 ppm PH 7.0
6. Reservoir Fracture Pressure:

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

No fresh water reported. It is probably in the thin veneer in glacial till that overlies the bedrock.

F. Mineral Resources (oil and gas, coal, brines, etc.)

The closest gas field is the Medina (Silurian) 5 to 10 miles away, while the Glade oil field is approximately 50 miles away. The nearest brine field is approximately 40 miles from the disposal well. There is no commercial coal in New York. The mining of gypsum is estimated to be about 25 miles away.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	17½"	H-40, 48 lbs/ft	13 3/8"	91'	Besse Portland; 100 sacks 2% calcium chloride
Intermed.	12¼"	H-40, 32 lbs/ft	9 5/8"	1201'	420 sacks 50-50 Poz mix 2% Bentonite & 18% salt
	8 3/4"	J-55, 23 lbs/ft	7"	3723'	550 sacks 50-50 Poz mix 2% Bentonite & 18% salt
Injection					
		"Fibercast" 1.75#/ft	2 7/8"	3800'±	
Other					

Describe bottom hole completion method: Open hole.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: 13 3/8" casing guide shoe with one centralizer placed one joint from bottom of casing. 9 5/8" casing guide shoe, cementing float collar placed one joint from bottom, canvas metal petal basket placed 20 joints from bottom; bottom wiper plug & top displacement plug and 4 centralizers at suitable intervals up the casing. 7" casing triplex retainer cementing shoe, see above for float collar, petal basket, etc. & 8 centrailizers placed at suitable intervals up the casing.

VI. Description of surface equipment

A. Holding tanks & flow lines 15 to 30 days back-up capacity. Steel holding tank.

B. Filters Filter down to 1 micron size - they are diatomaceous earth.

C. Pumps Centrifugal pumps with titanium lining.

D. Other

VII. Cores, samples, & Logs

A. Coring

Core No.		From	to	Recovery
1	From	3818'	3832' 9"	14' 9"
2	"	3925'	3948'	22' 6"
3	"	3970'	3982'	12'
4	"	4087'	4104'	17'
5	"	4130'	4163'	33'
	"			

B. Drilling Logs

___ Drillers Log

X Sample log

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity Guard — X Gamma ray-neutron

___ SP — ___ Temperature

X Caliper- Density — X Cement bond

___ Other ___

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Steel pickling liquors

B. Physical & chemical Description

0.5 to 5%	HCL	Viscosity ---
0 to 25%	$FeCl_2$	Temperature --- ambient
0 to 0.5%	$FeCl_3$	Ph --- extremely acid

Specific Gravity 1.1 to 1.2

C. Volume 75 gals/min.maximum

IX. Preinjection waste treatment Filtering

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Water	10 days	Theresa-Potsdam 3798'-4236'	1,071,237 gals of water were injected in a ten-day test program. All water was filtered through a 5-unit anthracite filter and treated with a biocide concentration of 10-15 ppm before injection.

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Theresa-Potsdam 3800' to 4300'	15% HCL Acid	Prior to pilot water injection the Cambrian section was acidized to clean the open-hole bore section. A total of 2000 gallons of HCL acid was used in the treatment. The acid was inhibited & contained a surfactan

C. Injection rates and pressures (Testing)

1. Rate

Date(s)	Average	Maximum
May 16, 1968	25	25
May 17, 1968	50	50
May 20, 1968	400	400
May 21, 1968	100	100
May 25 & 26, 1968	65	65

2. Pressure (well head X bottom hole ______)

Date(s)	Average	Maximum
May 16, 1968	360	330*
May 17, 1968	700	750*
May 20, 1968	1180	1180*
May 21, 1968	850	850*
May 25 & 26, 1968	700	700*

* Stabilized pressure

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements See Document 327-2841 (1/5/69) Instructions to Bidders, information sheets: "Well Cementing Specification," "Grabbing Specification," "Pilot Water Injection Pump Test Specifications," "API Model Form 442, First Edition August, 1962."

Construction Permit: See Pathbinder's letters of April 30, 1970 and May 26, 1970

B. Monitoring requirements Not in operation.

C. Restrictions on operating procedure Not negotiated as yet.

XII. Economics

A. Total and unit costs of construction Estimated between $800,000 - $900,000.

B. Operating costs Not in operation. Approximately 10 cents a gallon.

XIII. Source(s) of Information and Published References

1. AIDS - August 6, 1968 Completion Report - Waste Disposal test Well - WPL #1 Lackawanna Plant - Bethlehem Steel Corporation - Erie County, New York.

2. AIDS - August 13, 1968 - Supplement Completion Report on Waste Disposal Test Well - WPL #1, etc.

3. Numerous conferences between states agencies and representatives of Bethlehem Steel Corp., including AIDS.

4. New York State Geological Survey; Education Dept., Education Building, Albany, New York.

5. New York State Department of Environmental Conservation.

SYSTEM	SERIES	GROUP OR FORMATION	THICK-NESS	LITHOLOGY
Pleistocene	Glacial	drift	40	
Devonian	Middle	Hamilton	50	
		Onondaga	275	
Silurian	Upper	Salina	365	
	Middle	Lockport	250	
		Clinton	95	
	Lower	Medina	120	
Ordovician	Upper	Queenston	800	
		Oswego	130	
		Lorraine	435	
		Utica	150	
	Middle	Trenton	580	
		Black River	260	
Cambrian	Upper	[illegible]	425	
Pre-Cambrian	Crystalline Rocks			

GENERALIZED GEOLOGIC COLUMNAR SECTION
BUFFALO AREA, NEW YORK
EXHIBIT B

I. [illegible]

[illegible]

II. [illegible]

[illegible]

III. [illegible]

[illegible]

[illegible] Texas. 77027.

IV. Geology & Geohydrology

A. Regional geologic setting: [illegible]

[illegible]

IV. [illegible], continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation 538) (Total well depth [illegible])

Datum for depth measurement ____________

Name	Age	Depth (feet)	Bottom	Lithologic Description
[illegible]	Ordovician	115	1072	red and green silty shale
[illegible]	Ordovician	1072	1192	[illegible]
[illegible]	Ordovician	1192	1645	shale
[illegible]	Ordovician	1645	2440	limestone
[illegible]	Cambrian	2440	[illegible]	[illegible]
[illegible]	Precambrian	[illegible]	[illegible]	[illegible]

C. Geologic Description of Injection units & possible units not in use

Rock Unit

Name	Age	Depth (feet)	Thickness	Character and Areal Distribution
[illegible]	Cambrian	[illegible]	[illegible]	[illegible]
[illegible]	Precambrian	[illegible]	[illegible]	[illegible]

D. Engineering description of injection units

1. Porosity: ____________

2. Permeability: ____________

3. Original Reservoir Pressure: ____________

[illegible]

4. Reservoir Temperature: ____________

5. Chemical Character of Formation Water: ____________

Calcium 27,[illegible] ppm Bicarbonate [illegible] ppm [illegible] ppm Specific Gravity [illegible]

Sodium [illegible] ppm [illegible] ppm [illegible]

Chloride [illegible] ppm [illegible] ppm pH 10.5

Magnesium [illegible] ppm Total dissolved solids [illegible] ppm

6. Reservoir Fracture Pressure: ____________

[illegible]. Fresh water aquifers in vicinity

[illegible]	[illegible]	Thick-ness	[illegible]	[illegible] Quality
		[illegible] 100'		

B. Mineral Resources (oil and gas, coal, brines, etc.)

[illegible] gas field is more than 10 miles away. Oil production over [illegible] miles south of the well site. The nearest brine field is over 30 miles SW from the well site. The mining of gypsum is about 15 miles SW of the well site.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Conductor	[illegible]			16"	52'	
Surface	17½"	48#/ft	H-40	13 3/8"	228.67'	175 sacks class A [illegible] Cement 3% [illegible] 15.5 [illegible]
Intermed.	10 5/8"	24#/ft	J-55	8 5/8"	1195'	300 sacks class [illegible] Cmt 2% gel [illegible] 15.5#/[illegible]
	7 7/8"	15.5#/ft	J-55	5½"	2455'	600 cu.ft. class A cement 15.5#/gal. slurry wt.
Injection	E.U.E. tubing	6½#/ft	TK-90	2 7/8"	2465'	w/[illegible] [illegible] proposed

Other

Describe bottom hole completion method: Open hole.

V. Well design and construction, continued 4.

E. Packers, centralizers, well head equipment, etc.

13 3/8" casing with Baker float shoe and 3 centralizers [illegible]

8 5/8" casing with Baker guide shoe & Baker float collar with 5 centralizers.

An O.C.T. head installed and set at 2.75' below ground level.

5½" 6 Baker casing centralizers set @ 2640', [illegible]

A Baker Model D Packer was run on 2 7/8" [illegible] tubing to [illegible]

VI. Description of surface equipment

A. Holding tanks & flow lines Seven tank [illegible] of [illegible] gallons capacity. Emergency reserve pit.

B. Filters Two banks of disposable cartridges. The cartridge life will be approximately 1½ to 2 weeks before becoming dirty and need to be changed.

C. Pumps Two centrifugal transfer pumps.

D. Other Monitoring

VII. Cores, samples, & Logs

A. Coring None

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

___ Drillers Log

x Sample log

___ Drilling time

___ Other: [illegible]

[illegible]

VII. -- [illegible], [illegible], & logs, continued

C. Other logs run

____ [illegible]

____ [illegible]

____ Caliper

X Sidewall [illegible] ray-neutron porosity

X Temperature

x Cement bond

____ Other Cement Bond Log, Density Log, Neutron-Porosity Log.

VIII. Waste characteristics

A. Industrial Process from which waste is derived

Chemical Co.-Manufacture of Insecticides, Herbicides, Fungicides, and so forth.

B. Physical & chemical Description

[illegible] (sodium and ammonium) Viscosity 1.[illegible]

[illegible] sodium chloride Specific Gravity 1.[illegible]

[illegible] pH 6.[illegible] @ 25°C

[illegible]

[illegible]

[illegible] carbonate

C. Volume [illegible] gals/min @ [illegible] psig

[illegible] J. J. Jones to C. B. [illegible] gals/min @ [illegible] psig

[illegible] gals/min under 1000 psig

[illegible] gals/min under [illegible] psig

[illegible] [illegible] but not [illegible]

IX. Preinjection waste treatment [illegible]

X. Well Operation & Operating History

A. Tests

Type	Duration	Zones Tested	Description of test results
[illegible]	7/3/68 to 7/4/68	Theresa-Potsdam [illegible]	Pumped 4000 gallons of water w/1 gallon of Hypochlorite/2000 gallons. Filtered w/diatomaceous earth. Pumped as in X C (below). Date started 7/3/68. Date completed 7/4/68 and left well shut in. Released rig at 4:00 a.m. on 7/4/68.

B. Treatment or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
[illegible]	[illegible] hydrochloric acid	[illegible] 2000 gals. of [illegible] HCl and followed by 1000 gallons of acid.

C. Injection Rates and Pressures (Testing) 4000 gals of water w/1 gallon of hypochlorite/2000 gallons. Pumped as follows.

42 gallon/barrel

1. Rate

Date(s)		Average		Maximum
1/ 7/3/68	Average	[illegible] gals	Maximum	
2/ 7/3/68	"	[illegible] gals	"	
3/ 7/3/68	"	[illegible] gals	"	
4/ 7/3/68	"	[illegible] gals	"	
5/ 7/3/68	"	[illegible] gals	"	

2. Pressure (well head ________ bottom hole ________)

Date(s)		Average		Maximum
1/ 7/3/68	Average	[illegible] P.S.I.	Maximum	
2/ 7/3/68	"	[illegible] P.S.I.	"	
3/ 7/3/68	"	[illegible] P.S.I.	"	
4/ 7/3/68	"	[illegible] P.S.I.	"	
5/ 7/3/68	"	[illegible] P.S.I.	"	

7/4/68. Shut in. Released rig at 4:00 a.m.

X. Well operation & operating history - well was not approved for operation.

D. Description of operating programs:

E. Operating problems: Not approved

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction No data.

B. Operating costs

XIII. Source(s) of Information and Published References 10/10/63-Dow Chemical Company - "Completion Report Disposal Well No. 1 with Surface Equipment for F.M.C. Corporation - Niagara Chemical Division - Middleport, New York," by James R. Paul, P.E.

SYSTEM	SERIES	GROUP OR FORMATION	THICK-NESS	LITHOLOGY
Pleistocene	Glacial	Drift	5-25	
Silurian	Middle	Lockport	140	
		Clinton	[illegible]	
	Lower	Medina	110	
Ordovician	Upper	Queenston	900	
		Oswego	110	
		Lorraine	535	
		Utica	195	
	Middle	Trenton	490	
		Black River	235	
Cambrian	Upper	Theresa Potsdam	150	
Pre-Cambrian	Crystalline	Rocks		

Fig. 2. GENERALIZED COLUMNAR SECTION of Western New York

F.H.C.

WELL FILE NUMBER

Board of Air and Water Resources
Permit No. 1395
STATE

NC-1
UMR

I. Operating Company & General Well Location

Hercules Incorporated

Wilmington, North Carolina

II. Well location (legal description)

Location: The well is located at the Hercules Inc. Plant about four miles northwest of Wilmington east of highway 1421, in New Hanover County.

III. History, system planning, construction & operation.

A permit was issued by the North Carolina Board of Air and Water Resources to Hercules Inc. to construct and operate a wastewater injection well on an experimental basis. The injection system was placed in operation in May 1968. A rapid rise in injection pressure occured, apparently as a result of plugging the formation. The first injection well was permanently taken out of service in October, 1969, because of partial plugging with fine sand. Several of the five original observation wells were then used for injection and a new injection well drilled. One observation well and a second injection well are presently in use, but are to be closed down by about June 1973, and replaced by surfaces treatment facilities.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the Atlantic Coastal Plain. The beds dip south eastward (Seaward), at about 10 feet per mile.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation________) (Total well depth about 1100ft.)

Datum for depth measurement________

Name	Age	Depth (top)	Thickness	Lithologic Description
	Tertiary & Quaternary		50ft.	unconsolidated sands
Peedee Formation	Cretaceous	50ft.	650ft.	sandstones, clays, & limestones
Black Creek Fm.	Cretaceous	700ft.	400ft.(total drilled)	sandstones, clays & limestones

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Black Creek Fm.	Cretaceous	700ft.	400ft.(drilled)	

injection is into sands below 900 feet

D. Engineering description of injection units

1. Porosity:________
2. Permeability: less than 10,000gpd/ft. transmissivity
3. Original Reservoir Pressure: 90 feet above sea level (about 516 psi at 1100 feet).
4. Reservoir Temperature.________
5. Chemical Character of Formation Water:________
6. Reservoir Fracture Pressure:________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
	0 to 100ft.		unconsolidated sands	fresh

F. Mineral Resources (oil and gas, coal, brines, etc.)

None

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method: screended

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity

SP

Caliper

Other

X Gamma ray-neutron

X Temperature

Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of dimethyl terephthalate (DMT) used in synthetic fibre production.

B. Physical & chemical Description The wastewater contains about 15,000 ppm acetic acid, 5,000 ppm formic acid, 500 ppm methanol, and has a pH of about 4.

C. Volume 300,000 gallons/day

IX. Preinjection waste treatment Filtration to remove +20 micron solids, deaeration, and pH adjustment with lime. The deaeration and pH adjustment have been discontinued.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Pump testing of the injection interval.			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

	Date(s)		Average		Maximum
		May 1968		200gpm	
1.	"	Aug. 1969	"	"	"
	"	Sept. 1969	"	"	"
2.	"	March 1970	"	"	"
	"	Oct. 1970	"	"	"

2. Pressure (well head X bottom hole)

	Date(s)		Average		Maximum
		May 1968			
1.	"	Aug. 1969	"		"
	"	Sept. 1969	"		"
2.	"	March 1970	"		"
	"	Oct. 1970	"		"

1. initial well shut down
2. well worked over

X. Well operation & operating history

D. Description of operating programs: Injection is intermittent

E. Operating problems: The formation used for injection has a low permeability and problems of plugging of the injection horizon have occurred peric dically since injection began.

XI. Regulatory aspects.

A. Construction requirements A program of well logging and testing was specified for the second injection well and for the observation wells.

B. Monitoring requirements Five observation wells were originally required. Construction of a total of 15 observation wells by the end of 1972 is required. Monitoring of rate of injection and injection pressure for the injection well is required and water level measurement and sampling of the

C. Restrictions on operating procedure Injection pressure is restricted to 150 psi and waste volume is limited to 300,000 gpd. (200 gpm). It is required that the waste be neutralized before injection.

(continuation XI - B) observation wells is required as specified.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

North Carolina Department of Natural and Economic Resources

Ground Water Division

WELL FILE NUMBER　　Ohio　　Oh-1
　　　　　　　　　　STATE　　ORSANCO

I. Operating Company & General Well Location

Empire Reeves Div. Cyclops Corp.
Mansfield, Ohio

II. Well location (legal description)

Richland Co. Madison Twp. 766' FSL & 1024' FWL of NE¼ Sec. 16

III. History; system planning, construction & operation.

permit application - 7-16-67
permit granted - 7-17-67
well spudded - 9-3-67
well completed - 9-18-6[illegible]
well testing - 9-[illegible]-67
injection started - [illegible]-68
well plugged - [illegible]-71

Tubing leak detected & annular injection started 4-69. Tubing replaced 6-69. Annular injection resumed 10-69. Attempt to rework well 6-70, well plugged due to casing and tubing corrosion

IV. Geology & Geohydrology

A. Regional geologic setting: eastern flank of Cincinnati Arch - site on Mississippian bedrock

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ✓; no____).

(Ground elevation 1162') (Total well depth 5085')

Datum for depth measurement ________________

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Mt. Simon	Cambrian	1202'	82'	sandstone - widespread

D. Engineering description of injection units

1. Porosity: 10% (ave.)
2. Permeability: DST 12.6 to 24.5 md Core 9 md.
3. Original Reservoir Pressure: extrapolated 2050 #
4. Reservoir Temperature: 105° F
5. Chemical Character of Formation Water: Analysis attached
6. Reservoir Fracture Pressure: no fracture or breakdown pressures noted

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
ur				

F. Mineral Resources (oil and gas, coal, brines, etc.)

see well log

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	13½	32.75#	J-55	10¾"	675'	375 sks. 5% Pozmix
Intermed.	8¾	23#	J-55	7"	4075'	cemented to surface in 2 stages
Injection	Plastic lined		EVE	3½	4274	on packer

Other

Describe bottom hole completion method: open hole casing set on top of sand. No stimulation treatment reported, but 3,000,000 gallons of freshwater buffer zone created

V. Well design and construction, continued

B. [illegible], [illegible] liners, well head equipment, etc:

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From	4993′	to	5093′	Recovery	Mt. Simon sand
"	5053		5083′		Mt. Simon & PE g…
"					
"					
"					
"					

B. Drilling Logs

✓ Drillers Log attached

✓ Sample log

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs. continued

C. Other logs run

✓ Resistivity

✓ SP

✓ Caliper

✓ Gamma ray-neutron

___ Temperature

✓ Cement bond

___ Other *Density, Guard*

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

spent pickling liquors from steel processing

B. Physical & chemical Description

Iron as Fe - 93,730 ppm

Copper as Cu - 282 ppm *s.g. 1.195*

Zinc as Zn - [illegible] ppm *Freezing Pt. -6°C*

Total Residue - [illegible] ppm *Particle size -*

Acid Content - 10.9% *20-200 microns*

pH < 2.0 *50% < 60 µ*

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Mt. Simon	fresh water	3,000,000 no breakdown noted

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ____________ bottom hole ____________)

Date(s)	Dec. '68	Average	—	Maximum	1500#
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction ______

B. Operating costs ______

XIII. Source(s) of Information and Published References ______

Ohio Division of Geological Survey

Operators tops

ELECTRICAL LOGGING OF THE DISPOSAL WELL

A Gamma Ray-Neutron, Guard, Density, Caliper suite of logs were run on the well. Formation units, as picked from the Gamma Ray-Neutron log are as follows:

Fill and Gravel	0000 - 0052	feet
Fresh water sandstone	0052 - 0085	"
Cuyahoga shale	0085 - 0468	"
Sunbury shale	0468 - 0472	"
Berea sandstone	0472 - 0616	"
Bedford shale	0616 - 0675	"
Ohio shale	0675 - 1150	"
Olentangy shale	1150 - 1238	"
Delaware limestone	1238 - 1270	"
Columbus limestone	1270 - 1381	"
Tymochtee dolomite	1381 - 1622	"
Greenfield dolomite	1622 - 1934	"
Lockport dolomite	1934 - 2126	"
Clinton shale	2126 - 2148	"
Brassfield limestone	2148 - 2187	"
Cataract formation	2187 - 2322	"
"Clinton sandstone"	absent	
Queenston shale	2322 - 2520	"
Reedsville formation	2520 - 3532	"
Eden shale	3340 - 3334	"
Utica shale	3334 - 3453	"
Cynthiana limestone	3453 - 3532	"
Trenton limestone	3532 - 3696	"
Black River limestone	3696 - 4082	"
Gull River limestone	4082 - 4148	"
Glenwood formation	4148 - 4174	"
Trempealeau dolomite	4174 - 4354	"
Franconia dolomite	4354 - 4554	"
Conasauga dolomitic sandstone	4554 - 4634	"
Eau Claire dolomite	4634 - 4982	"
Mt. Simon sandstone	4982 - 5064	"
pre-Cambrian granite	5064 - 5085	"

Electrical log analysis of the Lockport dolomite, Trempealeau dolomite, Franconia dolomitic sandstone and Mt. Simon sandstone are presented on the following pages. It should be noted that the Guard, Density and Caliper logs read two (2) feet deeper than the Gamma Ray-Neutron log and the former logs were adjusted to the Gamma Ray-Neutron log for interpretation purposes.

Empire - Reeves
M. Simon Reservoir Fluid

	M. Simon Fluid Drill Stem Test
pH	5.4
Specific Gravity	1.200 @ 73°F
Bicarbonate	24 mpl*
Chloride	183,000 "
Sulfate	0 "
Calcium	37,500 "
Magnesium	3,950 "
Sodium	67,900 "
Total Dissolved Solids	292,000 "
Total Iron	145 "

*mpl - milligrams per liter

WELL FILE NUMBER Ohio #2 OH-2 P# 4
STATE

I. Operating Company & General Well Location

Armco Steel Corp.
Middletown, Ohio

II. Well location (legal description)

Butler Co. Lemon Twp. 1955' FNL & 65' FWL of NW¼ of Sec. 8

III. History, system planning, construction & operation.

Permit application to drill & test - 1-5-67
" " to inject - 9-25-67
Permit granted to drill & test - 2-14-67
" " to use for injection - 10-20-67
Well spudded - 8-25-67
Well completed - 3-12-67
Injection started - 6-67
well plugged

IV. Geology & Geohydrology

A. Regional geologic setting: Site is on Ordovician bedrock (Maysville fm). Structurally area is a few miles north of axis of Cincinnati Arch. Beds have moderate westerly dip to northwest.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ✓; no ___).

(Ground elevation 659') (Total well depth 3296')

Datum for depth measurement ___

Name	Age	Depth (top)	Thickness	Lithologic Description
copy attached				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2951 (log)	282'	sandstone - widespread

D. Engineering description of injection units

1. Porosity: ave. 7-14%
2. Permeability: variable
3. Original Reservoir Pressure: not recorded
4. Reservoir Temperature: 86° (from log heading)
5. Chemical Character of Formation Water:
   T.D.S. 189,000 milligrams/liter
   analysis attached
6. Reservoir Fracture Pressure: not recorded

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, And Cement

	Hole Size	Casing or Tubing Weight & Grade		Size	Depth Set	Type & Amount of Cement
Surface	17 1/2	48#	H-40	13-3/8	310'	250 sks.
Intermed.	12 1/4	36#	J-55	9-5/8	2922	900 sks.
Injection		9.3#	J-55	3 1/2	2906	50 sks.

Other

Describe bottom hole completion method: open-hole with casing set on top of sand

V. Well design and construction, continued 4.

B. Packers, Centralizers, well head equipment, etc: annulus fluid refined mineral oil under pressure of 600 psi with monitor gauges

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
2858'	2881'	Eau Claire sh ss
" 2975'	3025'	Mt Simon ss.
" 3025'	3075'	Mt Simon ss.
" 3150'	3200'	Mt Simon ss.
"		
"		

B. Drilling Logs

✓ Drillers Log tops attached ___ Drilling time

___ Sample log ___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

✓ Resistivity
✓ SP
✓ Caliper
✓ Other FD.✓ (density), Sonic
✓ Gamma ray-neutron
✓ Temperature
✓ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Steel manufacture

B. Physical & chemical Description

Hydrochloric acid pickle liquor and pickle rinse water ; maximum 1% HCL, 25% $FeCl_2$, 1½% $FeCl_3$

C. Volume ± 1.3 million gallons per month when operating; cumulative volume 16,401,909 gallons as of 8-71

IX. Preinjection waste treatment Filtration by pressure leaf-type filter capable of removing suspended solids larger than 2 microns.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Mt. Simon	Fresh Water	4,900,000 gallons

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
~~[illegible]~~	~~[illegible]~~	~~80#~~
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ____________ bottom hole ____________)

Date(s)	Average	Maximum
July, '71	0-50#	80#
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: ______________________________

E. Operating problems: ______________________________

XI. Regulatory aspects.

A. Construction requirements ______________________________

B. Monitoring requirements ______________________________

C. Restrictions on operating procedure ______________________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Ohio Division of Geological Survey

4/12/67
[redacted]

Armco Steel Corporation

Waste Disposal Well No. 1
Butler County, Ohio

Corrected Log Tops

	Top	Sub Sea	Thickness
Cynthiana Limestone	536	+131	102
Trenton Limestone	638	+ 29	28
Black River Group	666	+ 1	294
Chazy Limestone	960	-293	192
St. Peter Sandstone	1152	-485	20
Chepultepec dolomite	1172	-505	464
Copper Ridge dolomite	1632	-965	732
Maynardville dolomite	2364	-1697	59
Conasauga shale	2423	-1756	85
Rome formation	2508	-1841	338
Shady dolomite	2846	-2179	108
Mt. Simon Sandstone	2954	-2287	274
Basal Arkose	3228	-2561	8
Pre-Cambrian Basement	3236	-2569	

Armco #1
IWOW #2
Butler Co.

Mt. Simon reservoir fluid analysis

pH	6.1
Specific resistance, OHM/CM	7.8
Density:	9.35 lb/gal
	1.120 g/cc
Iron, total	24.4 mg/l
soluble	7.1 "
Dissolved solids	189,000 "
Sodium	40,200 "
Potassium	940 "
Calcium	20,400 "
Magnesium	2,500 "
Chloride	110,000 "
Sulfate	790 "
Acidity (Phen.) CaCO	40 "
Alkalinity (M.O.) $CaCO_3$	7 "

WELL FILE NUMBER Ohio
STATE OH. 3
NO.

I. Operating Company & General Well Location

Armco Steel Corp.
Middletown, Ohio

II. Well location (legal description)

Butler Co. Lemon Twp. 1190' FNL & 1965' FWL of NW¼ of Sec. 8

III. History, system planning, construction & operation.

permit application - 3·9·67
permit granted - 10·24·67
well spudded - 2·2·68
well completed - 4·24·68
injection started - May, 69
well plugged -

IV. Geology & Geohydrology

A. Regional geologic setting: Site is on Ordovician bedrock (~~Richmond~~ Maysville Fm.) Structurally area is a few miles north of axis of Cincinnati Arch. Beds have moderate west & northwest dip.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes ___; no ___).

(Ground elevation 667') (Total well depth 3285')

Datum for depth measurement ___

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2910'	339'	sandstone - widespread

D. Engineering description of injection units

1. Porosity: ___
2. Permeability: ___
3. Original Reservoir Pressure: ___
4. Reservoir Temperature: not recorded
5. Chemical Character of Formation Water: ___
6. Reservoir Fracture Pressure: ___

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			13 3/8	290	300 sks.
Intermed.			9 5/8	2916	
Injection		9.3# Nu-lock Porton lined	3 1/2	2915	
Other					

Describe bottom hole completion method: open hole with casing set on top of sand

V. Well design and construction, continued

B. Packers, centralizers, well head equipment, etc: annulus fluid refined mineral oil under pressure of 600 psi with monitor gauges

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From none to Recovery

B. Drilling Logs

✓ Drillers Log attached

Drilling time

Sample log

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity

___ SP

✓ Caliper

___ Other density.

✓ Gamma ray ~~neutron~~

___ Temperature

✓ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Steel manufacture

B. Physical & chemical Description

Hydrochloric acid pickle liquor and pickle rinse water; maximum 1% HCL, 25% $FeCl_2$, 1½% $FeCl_3$

C. Volume ≅ 1.3 million gallons per month when operating

IX. Preinjection waste treatment Filtration by pressure leaf type filter capable of removing suspended solids larger than 2 microns

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Mt. Simon	Fresh water	3,000,000 gallons

C. Injection rates and pressures

1. ~~Rate~~ Pressure

Date(s) Frequent Average 0-50 # Maximum 80 #

"

"

"

2. ~~Pressure~~ Rate (well head ______ bottom hole ______)

Date(s) ______ Average ______ Maximum ______

"

"

"

"

X. Well operation & operating history

D. Description of operating programs: ______

E. Operating problems: none reported

XI. Regulatory aspects.

A. Construction requirements ______

B. Monitoring requirements ______

C. Restrictions on operating procedure ______

XII. Economics

A. Total and unit costs of construction ______________________

B. Operating costs ______________________

XIII. Source(s) of Information and Published References ______

Ohio Division of Geological Survey

Schl.: CR-D-Cal., CB

S- 2206

Ohio Division Of Geological Survey

Permit No. 5

Permit Issued 10-26-67

County Butler Township Lemon Quadrangle Monroe

NWk Section 8 Lot Tract Twp. Quarter

Measured 1190' NL & 1365' WL of NW¼ of Sec. 8

765 Acres PG -IWDW-R

Land Owner Armco Steel Corp. Well No. 2 Date Commenced 4-2-68

Operator Armco Steel Corp. Well No. Date Completed 4-24-68

Elevation Bar 667 G, 671 KB L. 669 DF Total Depth 3285 Plugged Back

Formation Drld. To. Prod. Form. Prod. Nat.

I.P.

Init. Rock Press.

Casing Record 13-3/8"-298'w/300sks.;9-5/8"-2946'w/ Abandoned

Formation	Top	Bottom	Remarks	Formation	Top	Bottom	Remarks
South Zone				Dolo.	1630	2340	Copper R
X= 1,477,300				Dolo.	2340	2430	Maynardv
Y= 546,450				Shale-Sd.Dolo.	2430	2490	Conasaga
COMPLETION				" " "	2490	2940	Rome
Alluvium	0	5	Recent	Sandstone	2940	3232	Mt. Simo
Sd.-Gravel,Bolders	5	95	Pleist.	Arkosic Sd.	3232	3285	Basal Ar
Shale	95	415	Eden				
Lm.-Shale	415	620	Cynthiana-Million				
Limestone	620	840	Tr.				
" "	840	1030	B. Riv.				
Dolomite	1030	1150	Chazy				
Sandstone	1150	1200	St. Peter				
Dolo.	1200	1630	Chepultepec				

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WELL FILE NUMBER Ohio #4 STATE Oh-4 Well #

I. Operating Company & General Well Location

Vistron Corp. #1

Lima, Ohio

II. Well location (legal description)

Allen Co. Shawnee Twp. 150' FSL & 72' FEL of SE¼ of Section 2

III. History; system planning, construction & operation.

application to drill and test - 12-6-67

" to inject - 3-8-68

permit granted to drill & test - 1-9-68

" " to inject - 3-13-68

well spudded - 1-20-68

well completed - 2-24-68

Swab test - 2-25-68 ; injectivity test 2-26-68

injection started 7-5-68

well plugged

IV. Geology & Geohydrology

A. Regional geologic setting: Site is near axis of Findlay Arch. - Silurian bedrock

B. Geologic description of rock units penetrated by well
Rock Unit (Geologic Column included--yes____; no____).
(Ground elevation 864') (Total well depth 3133')
Datum for depth measurement______________

Name	Age	Depth (top)	Thickness	Lithologic Description
copy attached				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	2780	352'; entire unit not penetrated	sandstone - widespread

D. Engineering description of injection units

1. Porosity: 14.4%
2. Permeability: good (variable)
3. Original Reservoir Pressure: 1100 psi
4. Reservoir Temperature: 96° (from log heading)
5. Chemical Character of Formation Water:
Cl - 57,600 ppm , Mg - 1,400 ppm.
SO_4 - 1,460 ppm Na - 65,000 ppm
Ca - 7,200 ppm
analysis attached
6. Reservoir Fracture Pressure: no frac.

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	12 1/4"	32.75#	H-40	10 3/4"	434'	125 sks.
Intermed.	9"	20#	J-55	7"	2782'	
Injection	—	9.3#	J-55	3 1/2"	2838'	

Other

Describe bottom hole completion method: Casing set on top of sand

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	12 1/4"	32.75#	H-40	10 3/4"	934'	125 sks.
Intermed.	9"	20#	J-55	7"	2782'	
Injection	—	9.3#	J-55	3 1/2"	2838'	

Other

Describe bottom hole completion method: Casing set on top of sand

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From		to		Recovery
From	2794	to	3078	Mt Simon san
"	3078		3133	Mt. Simon
"				
"				
"				
"				

B. Drilling Logs

✓ Drillers log attached ____ Drilling time

✓ Sample log ____ Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

✓ Resistivity ✓ Gamma ray ~~neutron~~

✓ SP ___ Temperature

✓ Caliper ✓ Cement bond

✓ Other density, 3D-V log

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Acrylonitrile and Methacrylonitrile - Plant waste water column bottoms and recovery column stripper bottoms

B. Physical & chemical Description

Ammonia, sulfate, cyanide, aldehydes, organic acids, nitriles, and amides. Specific gravity about 1.06 to 1.12 depending on composition

C. Volume ≈ 6.8 million gallons per month
cumulative vol. 254 million gallons as of Sept. '71

IX. Preinjection waste treatment Surge pond (2.5 million gallons) for mixing, coagulating, and settling of solids. Filtration through sand filters, effluent run through cooling baffles when temperature of effluent nears 120°. At high temp. solids do not settle or filter properly.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

No fresh water buffer. Well was treated 3 times with acetonitrile to improve injection characteristics open hole 2783'-3133'

C. Injection rates and pressures

1. Rate

Date(s) ~~Sept.~~ '69 Average ≈ ~~900~~ " Maximum ______

2. Pressure (well head ______ bottom hole ______)

Date(s) Sept. '69 Average ≈ 900# Maximum 1250 #

X. Well operation & operating history

D. Description of operating programs: ______

E. Operating problems: Some problems with surface filters reported. Injection pressures have been high during summer months

XI. Regulatory aspects.

A. Construction requirements ______

B. Monitoring requirements ______

C. Restrictions on operating procedure ______

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Ohio Division of Geological Survey

VISTRON #1
MT. SIMON ANALYSIS

pH	7.3	
alkalinity to pH 8.2 as $CaCO_3$	0	mg/l
alkalinity to pH 4.6 as $CaCO_3$	70	"
chloride as Cl	57,500	"
sulfate as SO_4	1,450	"
calcium as Ca	7,200	"
magnesium as Mg	1,400	"
sodium as Na	65,000	"
Barium as Ba	low	"
hydrogen sulfide as H_2S	negligible	"
conductivity	81,200	μ mho

Formation	Top	Bottom	Remarks	Formation	Top	Bottom	Remarks
				KSR 6-27-68			
				Start 1-20-6?, comp. 6-27-68			
				Csg. 10"-430'w/225sks.; 7"-2782'w/450sks.			
				E. Log:			
				B. Ls.	32	408	
				Tr.	1232		
				B. Riv.	1436		
				G. Riv.	1776		
				Glen.	1509		
				Tpl.	1811		
				Gay	2223		
				Conn.	2383		
				Rome	2476		
				Shady	2525		
				Mt. Simon	2780		
				Core	2794	3133	
				T.D. 3133, L.TD 3133'			

WELL FILE NUMBER   Ohio   Oh-5
STATE

I. Operating Company & General Well Location

U.S.S. Chemicals Div. of U.S. Steel
Haverhill, Ohio

II. Well location (legal description)

Scioto Co., Green Twp. 7360' FSL, & 5550' FWL of Township

III. History; system planning, construction & operation.

permit application - 3-28-68
permit granted - 4-30-68
well spudded - 5-8-68
well completed - 7-5-68
well testing - 7-28-68
injection started water 9-1-69; waste 10-1-69
well plugged

IV. Geology & Geohydrology

A. Regional geologic setting: Eastern Flank of Cincinnati Arch - Site is on Lower Mississippian bedrock

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes___: no___).

(Ground elevation 546') (Total well depth 5617')

Datum for depth measurement ____________

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	5514	46'	sandstone - widespread

D. Engineering description of injection units

1. Porosity: ave. 11.9%
2. Permeability: ave. 26.8
3. Original Reservoir Pressure: 2633 psi
4. Reservoir Temperature: 107° (log heading)
5. Chemical Character of Formation Water: T.D.S. 316,000 mg/l analysis attached
6. Reservoir Fracture Pressure: 4500 psi

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	12 3/4	32.75 #	N-40	10 3/4 "	477	260 sks. posmix
Intermed.	8 3/4	26 #	N-80	7 "	5594	2170 sks.
Injection		9.3 # EUE	N-80	3 1/2	5519	pkr. @ 5422'

Other

Describe bottom hole completion method: set through sand, perforated, notched, and fraced

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: annulus fluid - inverted oil emulsion mud

VI. Description of surface equipment

A. Holding tanks & flow lines

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From 710	to 733'	Recovery Berea - sand
" 1805	1835'	Newburg - dolomi.
" 3979	4009'	St. Peter - dolomi
" 4242	4247'	Rose Run - sandst
" 4250	4262'	Rose Run - ss&c
" 5582	5573'	Mt. Simon - sands
5595	5617'	PE - granite

B. Drilling Logs

✓ Drillers Log

✓ Sample log

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

✓ Resistivity ✓ Gamma ray-~~neutron~~

✓ SP ✓ Temperature

✓ Caliper ✓ Cement bond

Other sidewall neutron porosity, collar, perf-collar.

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Oxidation of cumene to cumene hydroperoxide and its subsequent cleavage into phenol, acetone, & alpha methyl styrene

B. Physical & chemical Description

phenolic wastes - analysis attached

C. Volume ave. monthly - 4,000,000 gallons

cumulative volume - 93,467,405 gallons

IX. Preinjection waste treatment

1. impoundment
2. complete oil removal
3. filtration through coal filters
4. filtration through leaf filters
5. filtration through 5 micron guard filter
6. well injection

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results Recovery
drill stem		Berea 713-733'	30' mud
drill stem		Newburg 1795-1835'	1410' salt water s.g. 1.15
drill stem		Rose Run 4420-4365'	660' salt water s.g. 1.1
drill stem		Mt. Simon 5520-5565'	1895' salt water
drill stem		PE-granite 5575-5417'	2' mud

additional D.S.T. data attached on back

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Mt. Simon 5517-5599	Frac.	Acid frac. 6% HF & 9% HCL 500 gallons followed by 25,000 gal. H_2O & 30000# 20-40 sand at 1710 gpm
Mt. Simon	Fresh water	2,000,000 gal. buffer injected prior to waste injection

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ______ bottom hole ______)

Date(s)	Average	Maximum
Feb. 1971	1650#	1800#
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Ohio Division of Geological Survey

Haverhill Well

Operators Formation Tops

Formation Name	Depth From Kelly Bushing Elevation 557 (Schlumberger Measurements)
Coffee shale	679 - 699
Berea sand	699 - 767
Ohio Brown shale	858 - 1458
Ohio Big Lime (Corniferous)	1458 - 1518
Niagaran	1518 - 1792
Newburg	1792 - 1822
Rose Hill	1936 - 2202
Clinton	2202 - 2233
Queenston	2233 - 3252
Trenton	3252 - 3344
Tyrone	3344 - 3956
St. Peter	3956 - 3979
Beekmantown	3979 - 4225
Rose Run	4225 - 4254
Copper Ridge	4254 - 5030
Conasauga	5030 - 5082
Rome	5082 - 5196
Tomstown	5196 - 5514
Mt. Simon	5514 - 5564
Shaly sand	5564 - 5580
Granite	5580 - 5608
Schlumberger total depth	5608
Driller's total depth	5617

Waste Stream

Component	Component Flow, lbs/hr
Water (Condensate)	32,144
Phenol	44
Acetone	91
Sodium sulfate	1,315
Sodium bicarbonate	24
Sodium carbonate	218
Sodium formate	22
Cumene hydroperoxide	50
Total	33,908
Temperature, °F	120
Density, lbs/gal	8.61
Flow rate, gal/min	65.6

COMPANY USS Chemicals LEASE Haverhill
FIELD OR POOL
SECTION TWP. RGE. COUNTY Scioto STATE Ohio
SOURCE OF SAMPLE AND DATE TAKEN:
No. 1 1437 - Drill Stem Test No. 1 1/ 5-14-68
No. 2 1438 - Drill Stem Test No. 2 1/
No. 3 1442 - Drill Stem Test No. 3 1/
No. 4 1456 - Drill Stem Test No. 4 1/ 6- 4-68
No. 5

CHEMICAL AND PHYSICAL PROPERTIES

	NO. 1	NO. 2	NO. 3	NO. 4	NO. 5
SPECIFIC GRAVITY @ 60/60° F	1.005	1.193	1.199	1.225	
pH	11.3	5.4	6.7	5.5	
TOTAL ALKALINITY AS $CaCO_3$	256.	32.	60.	28.	
SUPERSATURATION AS $CaCO_3$					
UNDERSATURATION AS $CaCO_3$					
CALCIUM	608.	39,600.	39,800.	50,600.	
MAGNESIUM	7.	9,470.	7,610.	7,080.	
SODIUM	1,730.	46,900.	54,100.	58,300.	
BARIUM	0	0	0.	0	
SULFATE	130.	80.	74.	140.	
CHLORIDE	3,480.	170,000.	176,000.	200,000.	
SILICA	7.	3.	2.	2.	
TOTAL IRON	380.	39.	35.	39.	
ALUMINUM	2.1	.5	.5	.5	
TURBIDITY AS SiO_2	>150.	140.	>150.	>150.	
Iodide		2.7	1.3	1.3	
Bromide		1,820.	1,950.	2,160.	
Resistivity, Ω-M @ 77° F	.939	.048	.046	.047	
TOTAL DISSOLVED SOLIDS	6,600.	266,000.	278,000.	316,000.	
CARBON DIOXIDE	ND	280.	350.	240.	
HYDROGEN SULFIDE	ND	ND	ND	ND	
DISSOLVED OXYGEN	ND	ND	ND	ND	

REMARKS: 1/ DST No. 1 - Berea sand (713-733 ft), recovered 30 ft drilling fluid.
DST No. 2 - (1795-1835 ft), recovered 1410 ft salt water.
DST No. 3 - Rose Run sand (4220-4265 ft) bottom of recovery.
DST No. 4 - Mt. Simon sand (5520-5565 ft) bottom of recovery.

INJECTION RATE: B/D | PRODUCED WATER RATE: B/D
TREATMENT:

NOTE: N. D. = NOT DETERMINED. ALL RESULTS REPORTED AS MILLIGRAMS PER LITER UNLESS OTHERWISE MARKED.

Cores contd.

Interval	Unit	Recovery
5532-5562	Mt. Simon	sandstone
5563-5573	Mt. Simon	siltstone
5595-5617	PG granite	

5. Drill stem tests

Unit	Interval	ISI	FSI	IFP	FFP	RECOVERY
Berea	713-733	116	116	15	15	30' mud
Newburg	1795-1835	863	863	58	744	1410' salt water, SpG 1.19
Rose Run	4220-4265	1841	1825	39	340	660' salt water, SpG 1.185

WELL FILE NUMBER Ohio OH-6
STATE UMR

I. Operating Company & General Well Location

Vistron Corp. #2
Lima, Ohio

II. Well location (legal description)

Allen Co., Shawnee Twp., 448' FNL & 119 FWL of Sec. 11

III. History, system planning, construction & operation.

permit application - 5-16-69
permit granted - 7-3-69
well spudded -
well completed - 7-18-69
well testing -
injection started - 10-14-70
well plugged -

IV. Geology & Geohydrology

A. Regional geologic setting: Site is near axis of Findlay Arch - Silurian bedrock

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes ✓ ; no ___).

(Ground elevation 840') (Total well depth 3172')

Datum for depth measurement ________

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Mt. Simon	Cambrian	2800'	372'	sandstone-widespread

D. Engineering description of injection units

1. Porosity: ________
2. Permeability: ________
3. Original Reservoir Pressure: 1188 #
4. Reservoir Temperature: ________
5. Chemical Character of Formation Water: ________
6. Reservoir Fracture Pressure: ________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	13½"	Class A	H-40	10"	504'	400 sks.
Intermed.	9"	20#	K	7"	2811'	650 sks.
Injection		11.60#	API-K	4½	2809	on packer, coat w/TK-90

Other

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ______

VI. Description of surface equipment

A. Holding tanks & flow lines ______

B. Filters ______

C. Pumps ______

D. Other ______

VII. Cores, samples, & Logs

A. Coring

From	none	to		Recovery
"				
"				
"				
"				
"				

B. Drilling Logs

✓ Drillers Log tops attached ___ Drilling time

___ Sample log ___ Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

✓ Resistivity ✓ Gamma ray~~-neutron~~

✓ SP ___ Temperature

✓ Caliper ✓ Cement bond

___ Other density

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Acrylonitrile and Methacrylonitrile - Plant waste water column bottoms & recovery column stripper bottom

B. Physical & chemical Description

Ammonia, sulfate, cyanide, aldehydes organic acids, nitrites, and amides. Specific gravity about 1.06 to 1.12 depending on composition

C. Volume ≈ 8 million gallons per month
cumulative vol. 88 million gallons as of Sept. '71

IX. Preinjection waste treatment Surge pond (8.5 million gallons) for mixing, coagulating, and settling of solids. Filtration through sand filters. effluent run through cooling baffles when temperature of effluent nears 100°. At high temp. solids do not settle or filter properly

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Mt. Simon	Fresh water	6,136,000 gal. as buffer.

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum

2. Pressure (well head ______ bottom hole ______)

Date(s)	Average	Maximum
8-71	650#	755

X. Well operation & operating history

D. Description of operating programs: ______________________

E. Operating problems: ______________________

XI. Regulatory aspects.

A. Construction requirements ______________________

B. Monitoring requirements ______________________

C. Restrictions on operating procedure ______________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Ohio Division of Geological Survey

VISTRON #2

Formation	Top	Bottom	Remarks	Formation	Top	Bottom	Remarks
				NSR 9-25-69	Operators tops		
				Comp. 7-18-69			
				Csg.10"-504',400sks.,7"-2811',650sks.			
				I.W.D.W. #6			
				B. Lm.	532		
				Tr.	1244		
				B. Riv.	1416		
				G. River	1778		
				Glenwood	1820		
				Tpl.	1843		
				Maynard	2190		
				Conasauga	2392		
				Rome	2467		
				Shady	2570		
				Mt. Simon	2800	3143	
				Granite Wash	3143		
				TD 3170', L.TD	3172'		

WELL FILE NUMBER — *OHIO* STATE — *Oh-7* UMR

I. Operating Company & General Well Location

Calhio Chemicals (Div. of Stauffer) near Perry Village, Ohio

II. Well location (legal description)

Lake Co. Perry Twp. 1527' FSL & 435' FEL of Lot 47

III. History; system planning, construction & operation.

permit application - 6-15-70
permit granted - 2-11-71
well spudded - 3-5-71
well completed - 4-9-71
well testing - 4-26-71
injection started - not started as of Feb. 1972
well plugged -

IV. Geology & Geohydrology

A. Regional geologic setting: *The well is located on Upper Devonian bedrock (Ohio Shale). Beds dip gently to the southeast ≈ 10' per mile*

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included yes____; no____).

(Ground elevation 693') (Total well depth 6072')

Datum for depth measurement ____________

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Mt. Simon	Cambrian	5930'		sandstone - [illegible]
Kerbel	Cambrian	5540		sandstone

D. Engineering description of injection units

1. Porosity: ____________
2. Permeability: ____________
3. Original Reservoir Pressure: 2762#
4. Reservoir Temperature: 122° (log reading)
5. Chemical Character of Formation Water: ____________
6. Reservoir Fracture Pressure: ____________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface	13 3/4	32.75 #		10 3/4	512'	
Intermed.	9 1/2	26 #	J-55	7"	5936'	
Injection						
Other						

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
5357	5417'	Glenwood - Knox Sh. SS. dol.
5963	6023'	Mt. Simon arkosic SS.
6023	6075'	Mt Simon / PC sandstone / gran

B. Drilling Logs

✓ Drillers Log copy attached ____ Drilling time

✓ Sample log ____ Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ✓ Gamma ray ~~neutron~~

___SP ___Temperature

✓ Caliper ___Cement bond

___Other density, 3D-V, velocity

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of agricultural fungicides (Captan, Phaltan)

B. Physical & chemical Description Chloroform solubles - 3000 pp

NaCl - 25,000 ppm.	MEK solubles - 1200 ppm
Na_2SO_4 - 2000 ppm.	suspended solids - nil
Fe_2 - 300 ppm.	BOD - 3000 ppm.
Ca ion - 100 ppm.	COD - 4000 ppm.
Mg ion - 10 ppm.	Sp. G. - 1.025
Hexane soluble - 10 ppm.	ph - 7.0 to 7.5

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
D.S.T.		Mt. Simon 5907-6075	2100' salt water
D.S.T.		Kerbel 5450-5650	3300' salt water
D.S.T.		Knox 5300-5450	1500' mud cut salt wa

additional D.S.T. data attached on back

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ____________ bottom hole ____________)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Ohio Division of Geological Survey

Eird. GR,D;Gd;V;3-DV;Cal S-2509

Ohio Division Of Geological Survey

I W D W

Permit No. 142
Permit Issued 2-11-71
Quadrangle Perry
Twp. Quarter

County Lake Township Perry
Section Lot 47 Tract
Measured 1527' SL & 435' EL of Lot 47

PG - R.T.

Land Owner Calhio Chemicals, Inc. Well No. 1 Date Commenced 3-4-71
Operator Calhio Chemicals, Inc. Well No. Date Completed 4-28-71
Elevation Bar 693 G S.L. 700 DF 701 KB Total Depth 6072 Plugged Back
Formation Drld. To PG Prod. Form. Prod. Nat.
F/W 40M Gal. Wtr., 15M# Sd. 5936-6072' I.P.
Rock Press. Completed as Industrial Disposal
Casing Record 10-3/4"-512'240sks.;7"-5950'2M sks. Abandoned Well

Formation	Top	Bottom	Remarks	Formation	Top	Bottom	Remarks
X= 2,366,500				Lms.	2886	2900	Brassfield
Y= 762,200				Ss.	2900	2940	Grimsby
COMPLETION				Cabot Hd.	2940	2963	
Soil	0	7		Ss.	3066	3078	Whirlpool
Ohio Sh.	7	1358	Sl.S. Gas	Queen.	3078	3220	
Dela. & Cols.Lms	1358	1695		Reedsville	3220	4714	
Orisk. Ss.	1695	1712		Trenton	4714	4763	
Dol.	1712	1864	B.Island	Lms.	4763	4842	Eggleston
Evaps.	1864	2470	Salina	Lms.	4842	5209	Platteville
Dol.	2470	2548	Greenfield	Lms.	5209	5276	U-Chazy
Dol.	2548	2801	Lockport	Lms.	5276	5334	M-Chazy
Shale	2801	2886	Rochester	Lms.	5334	5370	L-Chazy
				Dol.	5370	5480	Copper Ridge

Formation	Top	Bottom	Remarks	Formation	Top	Bottom	Remarks
			Wtr. DST no shows				
Dol. & Ss.	5480	5630	Maynardsville Wtr. DST no shows	NSR 12-29-71			
Shale?	5630	5692	Conass.				
Dol.	5692	5736	Rome				
Dol.	5736	5928	Shady				
Mt. Simon	5928	6060	Wtr. DST-Noshows				
PRE Camb.	6060	6072					

Drill Stem Tests

Cores contd.

Interval	Unit	Recovery

5. Drill stem tests

Unit	Interval	ISI	FSI	IFP	FFP	RECOVERY
Mt. Simon	5907-6075	2716	2708	75	1061	2100' salt water
Kerbel	5450-5650	2676	2676	124	1450	3300' salt water
Knox	5300-5450	2422	2421	53	218	1300' mud cut salt water

WELL FILE NUMBER — *OHIO* (STATE) — *OH-8* (UMR)

I. Operating Company & General Well Location

International Salt Co.
Whiskey Island, City of Cleveland

II. Well location (legal description)

Cuyahoga Co., Brooklyn Twp. Whiskey Island
City of Cleveland Lot 51

III. History; system planning, construction & operation.

permit application - 4-20-71
permit granted - 6-1-71
well spudded - [illegible]
well completed - 8-3-71
well testing -
injection started - not reported as of 2-72
well plugged -

Well first drilled as "observation" well to Oriskany. Re-entered and converted to IWDW to dispose of Oriskany fluid now leaking into salt mine shafts.

IV. Geology & Geohydrology

A. Regional geologic setting: *Well is located on Upper Devonian bedrock (Ohio Shale). Beds dip gently to the southeast (towards Appalachian basin) ≈ 10' per mile.*

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation 585') (Total well depth 1435')

Datum for depth measurement ____________

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Oriskany	Devonian	1835'	87'	sandstone

D. Engineering description of injection units

1. Porosity: ____________
2. Permeability: ave 11 Meinzer Units
3. Original Reservoir Pressure: 565#
4. Reservoir Temperature: ____________
5. Chemical Character of Formation Water: ____________
6. Reservoir Fracture Pressure: ____________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade & type	Size	Depth Set	Type & Amount of Cement
Surface		J-55	5½"	300	cemented to surf
Intermed.		EVE J-55	2 7/8"	1330	100 sks. pozmix to surface
Injection		stainless steel	2"	1335	on packer
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From ___none___ to ____________ Recovery ____________

"
"
"
"
"

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other ____________________

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Brine seeps into mine shaft from Oriskany Sand

B. Physical & chemical Description

Sp. G. - 1.164

ph. - 5.5

T.D.S @ 110°c - 276.53 grams/liter

Total Sulfides as H_2S - 761 ppm.

Ca - 34,203 ppm

Mg - 8,674 ppm

C. Volume ave. monthly 15 gp/minute (648,000 gallons per month)

IX. Preinjection waste treatment filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ______ bottom hole ______)

Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: ______

E. Operating problems: ______

XI. Regulatory aspects.

A. Construction requirements ______

B. Monitoring requirements ______

C. Restrictions on operating procedure ______

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Ohio Division of Geological Survey

WELL FILE NUMBER STATE Ok-1 UMN

I. Operating Company & General Well Location

American Airlines Inc.

Tulsa, Oklahoma

II. Well location (legal description)

Location: NW 1/4, SE 1/4, Sec. 13, T20N, R13E, Tulsa County, Oklahoma.

III. History, system planning, construction & operation.

The well was completed in late 1959 and began operating during January, 1960. It is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated on relatively horizontal beds north of the Arkansas Valley Basin. There are several large normal faults east and west of the well site. The stratigraphic section consists of granites, sandstones, limestones, shales, & chert of Precambrian to Lower Pennsylvanian Age.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation________) (Total well depth 3036 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle	Ordovician	1729ft.	1300ft.	limestone and dolomit regionally distribute

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

The first saline water was encountered in the hole at a depth of 390 feet, so the maximum thickness of the fresh water is less than that. A thin fresh water sand was encountered at the base of a limestone at a depth of 180 feet. Shale occurs from 180 to 390 feet.

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			10 3/4in.	416ft.	
Intermed.	9in.		7 in.	1807ft.	
Injection			2 1/2in.		
Other					

Describe bottom hole completion method: open hole completion 1807 to 3036 ft.

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ________

VI. Description of surface equipment

A. Holding tanks & flow lines 1) 20,000 gal. tank, 15ft. underground acts as a sump 2) 30,000 gal. skimmer tank removes oil and sludge (not completely adequate) 3) 300,000 gal. equilizer basin with skimmer and scraper

B. Filters None

C. Pumps Two triplex positive displacement pump (150 gpm at 600 psig) located 10ft. below ground surface.

D. Other ________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity
____SP
____Caliper
____Other____
____Gamma ray-neutron
____Temperature
____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Chemical waste from airlines maintenance center

B. Physical & chemical Description Complete mixture of rinse water and batch dumpings from electroplating tanks, various organic solvents, cresols, phenols, detergents, paint removers, and oil pH range 5.6 to 9.4

C. Volume 400,000 gpd

IX. Preinjection waste treatment Settling and skimming of oil and sludge

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injection		Arbuckle	before acidizing
			97gpm at a well
			head pressure of
			177psi
Injection		Arbuckle	after acidizing
			610gpm at 169psi
			well head pressure

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Arbuckle	acidized with	
	15,000gal. HCl	

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum
October 1968	Average	400,000gpd	Maximum	
March 1971	"	10,500,000gpd	"	
"	"		"	
"	"		"	
"	"		"	

2. Pressure (well head X bottom hole)

Date(s)		Average		Maximum
October 1968	Average	400psi	Maximum	
March 1971	"	350psi	"	
"	"		"	
"	"		"	
"	"		"	

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: The only problems in the operation are mechanical problems which were quickle corrected.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements It was required that an observation well be constructed through all fresh water zones.

C. Restrictions on operating procedure The well was approved on the condition that it would remain in operation only as long as no pollution of fresh water strata was detected.

XII. Economics

A. Total and unit costs of construction $350,000.00

B. Operating costs

XIII. Source(s) of Information and Published References

Luff, G. S. 1960

Donaldson, E. 1964

Oklahoma State Health Department

WELL FILE NUMBER IW-69-026 STATE Ok-2 UMR

I. Operating Company & General Well Location

Nipak, Inc.
Box 338
Pryor, Oklahoma 74361

II. Well location (legal description)

Location: SE 1/4, NW 1/4, Sec. 33, T21N, R19E, Mays County, Oklahoma.

III. History, system planning, construction & operation.

The well was drilled in April, 1955 and began operating during June of the same year. The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northern flank of the Arkansas Valley Basin. The stratigraphic section consists of Precambrian to Lower Pennsylvanian granites, sandstones, limestones, and shales.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ____; no X).

(Ground elevation 603 ft.) (Total well depth 820 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description
Hindsville	Mississippian	0ft.	54ft.	
Moorefield	"	54ft.	64ft.	
Keokuk	"	118ft.	45ft.	
Reed Springs	"	163ft.	117ft.	cherty limestone
St. Joe	"	280ft.		fossiliferous limestone
Chattanooga	"			shale
Arbuckle	Ordocivian	358ft.	462ft.	limestone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle	Ordovician	358ft.	462ft.	limestone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: 21,670ppm Cl, 1,957ppm Ca, 10,000ppm Na, 870ppm Mg, 827ppm SO_4, 87ppm H_2S
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Not available				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.	12 1/2in.	J-55 24lb.	8 5/8in.	397in.	600 sacks
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines ____________

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From		to		Recovery	
From	None	to		Recovery	
"					
"					
"					
"					
"					

B. Drilling Logs

_X_ Drillers Log

___ Sample log

___ Drilling time

___ Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of Ammonia fertilizers

B. Physical & chemical Description Water and trace amounts of ammonia, urea, chromate, sodium chloride, and calcium sulfate.

30ppm CrO_4, 2.5ppm Zn, 60ppm Cl, 640ppm total hardness, Specific gravity 1.00, and pH 6.6

C. Volume 370,000 gpd

IX. Preinjection waste treatment skimming and sedimentation

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Arbuckle	Acidization	8,000 gal. 15% HCl
Arbuckle	Buffer injection	8.5 million gal. of fresh water

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
Date(s)	May 1971	Average	60gpm	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole)

Date(s)		Average		Maximum	
Date(s)	May 1971	Average	125psi	Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: The well operates 8 hours each day for five days per week.

E. Operating problems: There was a buildup of injection pressure which was corrected by acidization.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure None

XII. Economics

A. Total and unit costs of construction

$8,200. for drilling and completion

$5,000. for surface equipment

B. Operating costs $1,200. per year

XIII. Source(s) of Information and Published References

Oklahoma State Department of Health

WELL FILE NUMBER

STATE ______ Ok-3 UMR

I. Operating Company & General Well Location

Nipak, Inc.
Box 338
Pryor, Oklahoma 74361

II. Well location (legal description)

Location: NW 1/4, SE 1/4, Sec. 33, T21N, R19E, Mayes County, Oklahoma.

III. History, system planning, construction & operation.

The well was drilled in October, 1966 and began operating during the same year. The well is still in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: Same as Ok-2

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 599 ft.) (Total well depth 530 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Same as Ok-2				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle	Ordovician	397ft.	133ft.	massive limestone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water: Same as Ok-2
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Not available				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported.

V. Well design and construction

A. Casing, tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.		H-40 28lb.	8 5/8in.	358ft.	1655 sacks Portland
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ________

VI. Description of surface equipment

A. Holding tanks & flow lines ________

B. Filters ________

C. Pumps ________

D. Other ________

VII. Cores, samples, & Logs

A. Coring

From ____None____ to ________ Recovery ________

B. Drilling Logs

_X_ Drillers Log

___ Sample log

___ Drilling time

___ Other: ________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of ammonia fertilizers

B. Physical & chemical Description Water and trace amounts of ammonia, urea, chromate, sodium chloride, and calcium sulfate

4050ppm urea, 1,700ppm NH_3, 3.4ppm CrO_4, 100ppm $CaCO_3$, 1,700ppm TDS, Specific Gravity 1.00, and pH 9.6

C. Volume 370,000gpd

IX. Preinjection waste treatment skimming and sedimentation

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Arbuckle	Acidization	weak HCl

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
May 1971	225gpm	
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head X bottom hole)

Date(s)	Average	Maximum
May 1971	380psi	
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: Same as Ok-2

E. Operating problems: There was a buildup of injection pressure which was corrected by acidization.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure None

XII. Economics

A. Total and unit costs of construction

$10,000. for drilling and completion

$15,000. for surface equipment

B. Operating costs $13,500. per year

XIII. Source(s) of Information and Published References

Oklahoma State Department of Health

WELL FILE NUMBER | IX-70-001 STATE | Ok-4 UNR

I. Operating Company & General Well Location

United States Pollution Control, Inc.
2000 Classen Center, Suite 2000 South
Oklahoma City, Oklahoma 73106

II. Well location (legal description)

Location: SE 1/4, SE 1/4, Sec. 1, T19N, R7W, Kingfisher County, Oklahoma.

III. History, system planning, construction & operation.

The well was completed in May, 1966 and began operating in August of the same year. Five trucking firms discharge liquid waste from various industries into assigned inlets to the well. The waste is primarily salt water from oil and gas industries.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the east flank of the Anadarko Basin. The stratigraphic section consists of Pennsylvanian to Recent sand, shales, and limestone.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no_X__).

(Ground elevation 1168ft.) (Total well depth 5625ft.)

Datum for depth measurement Kelly Bushing 1180ft.

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Topeka	Pennsylvanian	3591ft.	100ft.	limestone
Hoover	"	3695ft.	449ft.	sand
LeCompton	"	4144ft.	581ft.	limestone
Endicott	"	4725ft.	845ft.	sand
Cottage Grove	"	5570ft.	145ft.	sand

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Same as above				

injection interval 3529ft. to 5570ft.

D. Engineering description of injection units

1. Porosity: 9%
2. Permeability: 250 md
3. Original Reservoir Pressure: 2100 psi
4. Reservoir Temperature: 115°F
5. Chemical Character of Formation Water:

115,000ppm Cl, 9,000ppm Ca, 38ppm SO_4, Specific gravity 1.105, viscosity 0.65cp, and pH 6.5

6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Not available				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported in the vicinity of the well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	12 1/4in.	J-55 24 lb.	8 5/8in.	404ft.	450 sacks
Intermed.	7 7/8in.	J-55 11.6lb.	4 1/2in.	5570ft.	675 sacks
Injection		J-55 4.7lb.	2 7/8in.	3529ft.	

Other

Describe bottom hole completion method: Perforated completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Baker Lok-Set Cretreivable) Packer at 3529 ft. Centralizers every 100 ft. from 3370 ft. to 5570 ft.

VI. Description of surface equipment

A. Holding tanks & flow lines 55,000 gal. stabilizing pond for emergency use.

B. Filters

C. Pumps

D. Other

VII. Cores, samples, & Logs

A. Coring - None

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___ Resistivity

___ SP

X Caliper

X Other Lateralog

___ Gamma ray-neutron

___ Temperature

___ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of G. E. computer components and oil and gas waste.

B. Physical & chemical Description 216ppm Cl, .075ppm phenols, 10ppm Cu, 1ppm Ag, viscosity .33cp, temperature 60°F, Specific gravity 1.054, and pH 3.98

C. Volume 15,000 to 300,000 gal. per month

IX. Preinjection waste treatment sedimentation

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
perforated zone	Acidization	500 gal. of 15% HCl
perforated zone	Buffer injection	10,000bbl fresh water

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
	3000bbl/day	
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ______ bottom hole ______)

Date(s)	Average	Maximum
	1300psi	
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs: The well operates approximately 15 hours per day

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements 3 to 5 pressure and rate readings daily

C. Restrictions on operating procedure None

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Oklahoma State Department of Health

U. S. Pollution Control, Inc. - Report

WELL FILE NUMBER W-69-001 STATE Ok-5 UNR

I. Operating Company & General Well Location

Cherokee Nitrogen Company - Oklahoma Ordinance Works Authority

II. Well location (legal description)

Location: SE 1/4, NW 1/4, Sec. 3, T20N, R19E, Mayes County, Oklahoma

III. History, system planning, construction & operation.

The well was constructed in June 1967 and is presently in operation.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located on the northern flank of the Arkansas Valley Basin. There are several large faults near the well site. The stratigraphic section consists of Precambrian to Pennsylvanian rocks, consisting of granite, limestone, sandstone, shale, and chert.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no X).

(Ground elevation 610 ft.) (Total well depth 912 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle	Ordovician	395ft.	517ft.	limestone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure: 200 psi
4. Reservoir Temperature: 85°F
5. Chemical Character of Formation Water: 37,922ppm TDS, 23,049ppm Cl, Specific gravity 1.026, pH 9.5
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Not available				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			14in.	125ft.	
Intermed.			10in.	415ft.	
Injection			6in.	435ft.	
Other					

Describe bottom hole completion method: open hole completion

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ______

Larkin removable packers

______

VI. Description of surface equipment

A. Holding tanks & flow lines ______

B. Filters ______

C. Pumps ______

D. Other ______

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log

____Sample log

____Drilling time

____Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other ____

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of ammonium nitrate

B. Physical & chemical Description 1044ppm TDS, 510ppm SO_4, 470ppm total hardness, temperature 80° to 105°F, Specific gravity 1.008, pH 7.0 - 8.4

C. Volume 180 gpm

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)		Average	175gpm	Maximum	200gpm
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head X bottom hole __________)

Date(s)		Average	175psi	Maximum	200psi
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: ______

E. Operating problems: None reported

XI. Regulatory aspects.

A. Construction requirements ______

B. Monitoring requirements Periodic chemical analysis of water in two shallow observation wells.

C. Restrictions on operating procedure Maximum surface injection pressure is limited to 350psi.

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Oklahoma State Department of Health

WELL FILE NUMBER IW-69-024 ~~STATE~~ Permit No. Ok-6 ~~UMR~~

I. Operating Company & General Well Location

North American Rockwell Corporation
3330 North Mingo Road
Tulsa, Oklahoma

II. Well location (legal description)

Location: SW 1/4, SE 1/4, NE 1/4, Sec. 24, T20N, R13E,
Tulsa County, Oklahoma

III. History; system planning, construction & operation.

Drilling began 9/25/67 and the well was completed in October. The well began operation in February, 1968 and is still operating.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is situated on relatively flat beds north of the Arkansas Valley Basin. Several large normal faults are located east and west of the well site. The stratigraphic section consists of granite, shale, sandstone, limestone, and chert from Precambrian to Lower Pennsylvania age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no____).

(Ground elevation_________) (Total well depth 3100 ft.)

Datum for depth measurement K.B.-above casing flange 11.5ft.

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Verdigris	Pennsylvanian	422		limestone
"Skinner through Fayetteville"		460		limestone, shale & sandstone
	Mississippian	1446		limestone and shale
Woodford	Devonian	1670		shale
Tyner	Ordovician	1722		sandstone
Arbuckle	"	1800	1190	dolomite
Regan	Cambrian	2990		sandstone
basement	PreCambrian	3100		granite

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Arbuckle	Ordovician	1800	1190	limestone and dolomite
				regionally distributed
Regan	Cambrian	2990	110	sandstone - regionally
				distributed

D. Engineering description of injection units

1. Porosity: Fracture and solution porosity
2. Permeability: ____
3. Original Reservoir Pressure: ____
4. Reservoir Temperature: ____
5. Chemical Character of Formation Water: Saline
6. Reservoir Fracture Pressure: ~ 800psi

IV. Geology & Geohydrology, continued

E. Geohydrology, fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Not available				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas is extensively produced in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing. Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	13 3/4"		10 3/4"	417'	286sks reg. portla circulated to surf
Intermed.					
	8 3/4"	J-55	7"	1806'	325ft.^{3} posmix & light cement circulated to surf.
Injection					
Injection tubing		fiberglass	2 7/8 I.D.	1825'	

Other a 10ft. section of Carpentar 20 at the bottom of 7in. casing strin

Describe bottom hole completion method: open hole completion from 1806 to T. D.

V. **Well design and construction, continued**

B. Packers, Centralizers, well head equipment, etc:
Baker model A tension packer constructed of Carpentar 20 alloy and a soft Hycar packer element Packer set in the 10ft. joint of Carpentar 20 7in. casing.

VI. **Description of surface equipment**

A. Holding tanks & flow lines 100,000gal. horizontal above ground storage tank.

B. Filters None

C. Pumps 2-300gpm @ 150psi centrifugal pumps

D. Other

VII. Cores, samples, & Logs

A. Coring - None

From ______ to ______ Recovery ______
" ______ ______ ______
" ______ ______ ______
" ______ ______ ______
" ______ ______ ______
" ______ ______ ______

B. Drilling Logs

____ Drillers Log

X Sample log

____ Drilling time

____ Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

X Resistivity-short normal and induction
X SP
X Caliper
__ Other Sidewall epithermal neutron, microlog
X Gamma ray-neutron
__ Temperature
X Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Rinse water from pre-bond processing line

B. Physical & chemical Description Not available

Effluent contains hexavelent chromium.

C. Volume Total (Acid and alkaline lines) volume normally averages 850,000 gal. per month (21 days - 1 shift operation)

IX. Preinjection waste treatment None

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
Injectivity		Arbuckle	after 1st acid treatment
			42gpm @ 150psi
Injectivity		Arbuckle	after 2nd acid treatment
			500gpm @ 150psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Arbuckle	acidized fractured	1,000gal. 15% HCl 42gpm @ 150psi
Arbuckle	acidized fractured	10,000gal. 15% HCl 500gpm @ 150psi

C. Injection rates and pressures

1. Rate

Date(s) Since operation began Average 100-125gpm Maximum ______

2. Pressure (well head X bottom hole ______)

Date(s) Since operation began Average 275psi Maximum ______

X. **Well operation & operating history**

D. Description of operating programs: Pumps are controlled by level controls located in the horizontal storage tank. System is completely automatic. Well annulus is equipped with high pressure alarm.

E. Operating problems: No problems were reported.

XI. **Regulatory aspects.**

A. Construction requirements None at time of construction. However, the Oklahoma Water Resources Board has issued technical order 200-1 which becomes effective November 14, 1972 (Industrial Waste Disposal Well Rules & Regulations)

B. Monitoring requirements 200ft. monitoring well nearby

C. Restrictions on operating procedure None reported

XII. Economics

A. Total and unit costs of construction

Total Cost - $186,000.

B. Operating costs Estimated $.45/1000gal.

XIII. Source(s) of Information and Published References

Oklahoma State Department of Health

North American Rockwell Corporation

FILE NUMBER IW-70-012 STATE Ok-7 UMR

Operating Company & General Well Location

Kerr-McGee Corporation - Cimarron Facility

Kerr-McGee Building

Oklahoma City, Oklahoma 73102

Well location (legal description)

Location: NW 1/4, SW 1/4, Sec. 12, T16N, R6W, Logan County, Oklahoma

History; system planning, construction & operation.

The well was constructed in October 1968 has not been put into operation. Little information is available, since Kerr-McGee has not applied for an Atomic Energy Commission License to operate this well.

Geology & Geohydrology

A. **Regional geologic setting:** The well is structurally located on the northeast flank of the Anadarko Basin and the regional dip is toward the southwest. The stratigraphic section consists of Permian to Recent beds of sands, shales, limestone, and dolomite.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation________) (Total well depth 2078 ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Wolfcamp	Permian			

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
Not available				

F. Mineral Resources (oil and gas, coal, brines, etc.)

No mineral resources are reported.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____________

VI. Description of surface equipment

A. Holding tanks & flow lines 4 holding ponds with a total capacity of approximately 4,000,000 gal.

B. Filters ____________

C. Pumps ____________

D. Other ____________

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

____Drillers Log ____Drilling time

____Sample log ____Other: ____________

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity

____SP

____Caliper

____Other

____Gamma ray-neutron

____Temperature

____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of nuclear fuel material.

B. Physical & chemical Description Liquid process wastes containing ammonium fluoride, ammonium nitrate, dissolved ammonia, nitric acid, and traces of uranium, and plutonium.

C. Volume

IX. Preinjection waste treatment Centrifuging, anion exchange, and filtration

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
None			

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
None		

C. Injection rates and pressures

1. Rate

Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

2. Pressure (well head ____________ bottom hole __________)

Date(s)		Average		Maximum	
"		"		"	
"		"		"	
"		"		"	
"		"		"	

X. Well operation & operating history

D. Description of operating programs: ____________________

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements ____________________

B. Monitoring requirements ____________________

C. Restrictions on operating procedure None

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Oklahoma Department of Health

WELL FILE NUMBER IW-70-011 STATE Ok-8 UMR

I. Operating Company & General Well Location

Kerr-McGee Corporation - Sequoya Facility

Oklahoma City

II. Well location (legal description)

Location: NE 1/4, Sec. 21, T12N, R21E, Sequoya County, Oklahoma

III. History; system planning, construction & operation.

The well was constructed in October 1969 but is not yet in operation. The waste is presently being discharged into a nearby river. Little information is available because an Atomic Energy Commission license to operate this well has not been granted to Kerr-McGee and further details are considered confidential at this time by the AEC.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located within the Arkansas Valley Basin. The stratigraphic section consists of granite, sandstone, limestone, and shales of Precambrian to Lower Pennsylvanian age.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included -yes____; no X).

(Ground elevation________) (Total well depth 3100ft.)

Datum for depth measurement Ground Level

Name	Age	Depth (top)	Thickness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Arbuckle	Ordovician			massive limestone

D. Engineering description of injection units

1. Porosity:
2. Permeability:
3. Original Reservoir Pressure:
4. Reservoir Temperature:
5. Chemical Character of Formation Water:
6. Reservoir Fracture Pressure:

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Not available				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Oil and gas are produced near the disposal well.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface					
Intermed.					
Injection					
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ___

VI. Description of surface equipment

A. Holding tanks & flow lines 2 sludge pits, a clarifier lagoon, and an evaporation lagoon

B. Filters ___

C. Pumps ___

D. Other ___

VII. Cores, samples, & Logs

A. Coring

From ___ to ___ Recovery ___
" ___ ___ ___
" ___ ___ ___
" ___ ___ ___
" ___ ___ ___
" ___ ___ ___

B. Drilling Logs

___Drillers Log ___Drilling time
___Sample log ___Other: ___

VII. -- Cores, samples, & logs, continued

C. Other logs run

- ____Resistivity
- ____SP
- ____Caliper
- ____Other ____
- ____Gamma ray-neutron
- ____Temperature
- ____Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Manufacture of uranium hexaflouride

B. Physical & chemical Description Clarified lime effluent, treated hydro-fluoric acid scrubber waste, cooling tower and boiler blowdown, domestic waste, and waste treatment brine.

C. Volume ____

IX. Preinjection waste treatment lime treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures

1. Rate

Date(s) ______ Average ______ Maximum ______
" ______ " ______ " ______
" ______ " ______ " ______
" ______ " ______ " ______
" ______ " ______ " ______

2. Pressure (well head ______ bottom hole ______)

Date(s) ______ Average ______ Maximum ______
" ______ " ______ " ______
" ______ " ______ " ______
" ______ " ______ " ______
" ______ " ______ " ______

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: No problems were reported.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Oklahoma State Department of Health

WELL FILE NUMBER IN-71-013 OK-9

STATE UNIT

I. Operating Company & General Well Location

Halliburton Services

Duncan, Oklahoma

II. Well location (legal description)

The well is located in Sec. 7, T1S, R7W, Stephens County, Oklahoma at Halliburton's Plant 2.

III. History, system planning, construction & operation.

The drilling was completed on August 31, 1970 and injection commenced September 23, 1970.

IV. Geology & Geohydrology

A. Regional geologic setting: The well is located within the Ardmore Basin and the regional dip is to the southeast. The stratigraphic section consists of primarily of Pennsylvanian and Permian sandstone, shale, limestone, and dolomite.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no X).

(Ground elevation 1108 ft.) (Total well depth 1272 ft.)

Datum for depth measurement____________________

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Red Beds	Permian	1216ft.	22ft.	red and gray shales

D. Engineering description of injection units

1. Porosity:____________________
2. Permeability: Impermeable
3. Original Reservoir Pressure:____________________
4. Reservoir Temperature: 65°F
5. Chemical Character of Formation Water:____________________
6. Reservoir Fracture Pressure:____________________

IV. Geology & Geohydrology, continued

E. Geohydrology. Fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
Not available				

F. Mineral Resources (oil and gas, coal, brines, etc.)

There are no mineral resources reported in the area.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing, Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	8 3/4in.	J-55 23 lb/ft.	7 in.	[illegible] ft.	[illegible]
Intermed.	6 1/4in.	J-55 11.6lb/ft.	4 1/2in.	[illegible] ft.	[illegible] barrels [illegible]
Injection		J-55 6.4lb/ft.	2 7/8in.	[illegible] ft.	[illegible]

Other

Describe bottom hole completion method: [illegible] at 1228 ft. with sand-water jet.

V. [illegible]

a. [illegible] Cementing, [illegible]: [illegible]
[illegible] 4 1/2 in.
[illegible]

VI. Description of surface equipment

a. [illegible]

b. Filters

c. Pumps

d. Other [illegible] only.

VII. Cores, samples, & logs

a. Coring

From [illegible] to [illegible] Recovery

b. Drilling logs

Driller's log

Drilling time

Sample log

Other

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity

___ SP

_X_Caliper

_X_Other___ Contact

___Gamma ray-neutron

___Temperature

___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Effluent from petroleum well services plant.

B. Physical & chemical Description The waste consits of fresh water and cement slurries

viscosity - 1 to 70 poise

temperature 50 to 90°F

specific gravity 1 to 2.5

pH 6.5 to 11

C. Volume 5400 gallons per week

IX. Preinjection waste treatment None

[illegible]

X. Well operation & operating history

D. Description of operating programs: Injection of waste is intermittant, occuring approximately twice each month.

E. Operating problems: Plugging occurred due to large cement particles migrating through the perforations. The casing was drilled out and restored.

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure Maximum surface injection pressure is 3000 psi.

XII. Economics

A. Total and unit costs of construction
Drilling and completion $[illegible],000.00

Surface equipment $ 3,[illegible]00.00

B. Operating costs $20.00 per hour during injection

XIII. Source(s) of Information and Published References
Oklahoma State Department of Health

WELL FILE NUMBER Penn. Permit STATE LS-BEA-1 Pa-1 UMR

I. **Operating Company & General Well Location**

Jones & Laughlin Steel Corp.

Aliquippa, Pa.

II. **Well location (legal description)**

Location: Beaver Co., Borough Twp. 9300'N 40° 35'

3000' E 80° 15'

III. **History; system planning, construction & operation.**

Permit application - 10-8-59

Permit granted 10-64

Well spudded - 8-10-60

Well completed - 9-12-60

Injection started - 4-10-61

The well was originally completed in the Oriskany Sandstone. Because of loss of injection capacity, it was recompleted in the Hamilton Shale and Tully Limestone in 1968.

IV. **Geology & Geohydrology**

A. **Regional geologic setting:** Upper Pennsylvanian bedrock consisting of cylic sequenses of shale, siltstone, sandstone, limestone and coal. The well is located in the Appalachian basin at the north end of the pitching Pittsburgh-Parkersburg syncline.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ✓; no___).

(Ground elevation 719') (Total well depth 5145')

Datum for depth measurement___

Name	Age	Depth (top)	Thickness	Lithologic Description
see attached description				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Oriskany	Devonian	5035'	37'	sandstone
*Hamilton	"	4970	46'	Shale
Tully	"	"	247'	limestone

the well was recompleted in the Hamilton Group in 1968

D. Engineering description of injection units

1. Porosity: Oriskany: av. 7.1% max. 11.5%
2. Permeability: .5 - 2.5 md.
3. Original Reservoir Pressure: 1700' standing in nearby well
4. Reservoir Temperature: N.G.
5. Chemical Character of Formation Water: highly saline connate water [illegible]% total dissolved solids [illegible]% Na, 12.12% Ca, 1.13% Mg, [illegible]% Cl & other ions .81%
6. Reservoir Fracture Pressure: 4300 PSIG

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
deepest fresh water aquifer - 200'				

F. Mineral Resources (oil and gas, coal, brines, etc.)

brines - coal (Freeport indicated) about 2000 oil & gas wells have been drilled in Beaver County

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			20"	73'	
Intermed.			13 3/8	211'	
			9 5/8	2106'	
~~Injection~~			7"	5271'	
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc:

Not indicated

Fresh water is circulated between the 7" & 3½" tubing stainless steel shoe set on top of Oriskany christmas tree to accomodate the waste line and fresh water circulation

VI. Description of surface equipment

A. Holding tanks & flow lines 2 day capacity surface tanks

B. Filters bank of manifold filters

C. Pumps 1 set of four diesel driven & 1 set of five electric pumps

D. Other

VII. Cores, samples, & Logs

A. Coring

From	5250'	to 5277'	Recovery 27'
"	5340'	5341'	1'
"	5345'	5392'	~~[illegible]~~ 47'
"	5405'	5413'	8'
"	5421'	5427'	6'
"			

B. Drilling Logs

✓ Drillers Log

✓ Sample log

____ Drilling time

____ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

✓ Resistivity

✓ SP

✓ Caliper

Other velocity

✓ Gamma ray-neutron

Temperature

✓ Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

steel pickling operations

B. Physical & chemical Description

H_2SO_4 -10% , $FeSO_4$ - 10%

C. Volume N.A.

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
D.S.T.	16 hr.	Oriskany	stood 1700' above bottom of hole

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Oriskany	Dowell Frac.	increase injection rates
Reworked up to Tully ls.		acidized w/ inhibited HCl

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
N.A.	100 gpm	

2. Pressure (well head ✓ bottom hole ______)

Date(s)	Average	Maximum
N.A.	2800 to 3500 psi	

X. Well operation & operating history

D. Description of operating programs: Well developed 1957-1960 - put on stream in 1960

E. Operating problems: Fiberglass tubing failed mechanically, replaced w/ Benton lined tubing; some joint corrosion; casing and cement corroded at places. Loss of injectivity in the original injection interval

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements pressure, volume and quality monitors. Quality - pH and specific conductance monitored on annulus fluid.

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

2.5 million total - including reworking in 1968

B. Operating costs 150,000 P.A.

XIII. Source(s) of Information and Published References

Penn. Department of Environmental Resources

FORMATION TOPS - GAMMA-RAY LOG

J. & L. Disposal Well
Aliquippa, Pa.

System, Group, Formation, Member	Top	Bottom	Thickness
Quaternary System		92	92
Pennsylvania System	92	450	358
Allegheny Group	92	275	183
Vanport Limestone	208	218	10
Pottsville Group	275	450	175
Mississippian System	450	1,032	582
Greenbrien Group	450	475	25
Pocono Group	475	1,032	557
Berea Sand Zone	960	1,032	72
Devonian System			
Upper Devonian Series	1,032	4,978	3,946
Conewango, Conneaut and Canadoway Groups, etc)			
Middle Devonian Series	4,978		
Hamilton Group	4,978	5,225	247
Tully Limestone	4,978	5,024	46
Onondaga Group	5,225	5,388	163
Lower Devonian Series	5,388	-	
Oriskany Group	5,388	5,425	37
Helderberg Group	5,425	-	18+
Total Depth		5,443	

WELL FILE NUMBER Penn. Permit STATE LS-ERI-1 Pa-2 UMR

I. Operating Company & General Well Location

Hammermill Paper Co.

Erie, Pa.

II. Well location (legal description)

Location: Erie Co., City of Erie, 42° 08' 53" W,
80° 03' 10" N

III. History, system planning, construction & operation.

Well spudded - 1/24/63

Well completed - 3/28/63

Injection started - 4/64

IV. Geology & Geohydrology

A. Regional geologic setting: At foot of Portage Escarpment Glacial drift (glaciated Allegheny Plateau). Devonian (Upper) shales at spud. Strike about East low dip to South next to lake Erie on possibly a higher lake stage beach.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ✓; no ___).

(Ground elevation 629') (Total well depth 2302)

Datum for depth measurement ___

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Tully	Devonian	1128'	88'	limestone
Hamilton	Devonian	1216'	130'	shale
Onondaga	Devonian	1346'	265'	limestone & chert
Bass Island	Silurian	1611'	77'	limestone - dolomite
Salina	Silurian	1688'	288'	Gyps., anhyd., salt, ls., & SA
Greenfield	Silurian	1976'	81'	limestone
Lockport	Silurian	2057'	245'	dolomite

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Bass Islands	Silurian	1611'	81'	limestone & dolomite
Lockport	Silurian	2057'	245'	dense nonporous dol.

D. Engineering description of injection units

1. Porosity: ___
2. Permeability: 2300 md. - calculated after acid
3. Original Reservoir Pressure: 900#
4. Reservoir Temperature: N.A.
5. Chemical Character of Formation Water:

   S.Gr. 1.205, °Baume 24.62, % $CaCl_2$ 9.35

   % $MgCl_2$ 3.09, % NaCl 10.04, % KCl 0.70
6. Reservoir Fracture Pressure: N.A.

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
N.A.				

F. Mineral Resources (oil and gas, coal, brines, etc.)

Brine in disposal zone; some gas show

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade		Size	Depth Set	Type & Amount of Cement
Surface		40#	H-40	13 3/8	40'	
Intermed.	11 3/4	36#	J-55	9 5/8	1359'	390 sks.
Injection	8 3/4	23#	J-55	7	8106'	175 sks.

Other

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Baker cast iron bridge plug at 1710' in 2" annulus

VI. Description of surface equipment

A. Holding tanks & flow lines tanks provided for emergency flows

B. Filters microscreens

C. Pumps Sun recirculating pumps - 196 gpm at 1530 psi

D. Other

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
N.A.		
"		
"		
"		
"		
"		

B. Drilling Logs

✓ Drillers log Tape

___ Drilling time

___ Sample log

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity ✓ Gamma ray-neutron

___SP ___Temperature

___Caliper ___Cement bond

___Other _velocity, Spinner_

VIII. Waste Characteristics

A. Industrial Process from which waste is derived.

paper mill digestor liquors (sulphite & lignins)

B. Physical & chemical Description _Spent sulfite pulping liquor containing fiber, fiber compounds, paper filter [illegible] such as clay and TiO, and lignin-like compounds in the colloidal and semi-colloidal price range_

_S.G. 1.03_ _Total SO_4 1.75 mg/l_ _S.S. 825 mg/l_

_pH 5.5_ _Cl 270 mg/l_ _Ca ($CaCO_3$) 80 mg/l_

TDS 5.0% _Alk: [illegible] 1500 mg/l_ _Mg ($MgCaCO_3$) 100 mg/l_

[illegible] 0.0 _acid phph - 1300 mg/l_

C. Volume

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
~~and~~ Lockport	acid	1½ bbl./min. at 1900 psig • [illegible] tight
Bass Islands	acid	4 bbl./min @ 1900 psig
		19 bbl./min @ 1300 psig
		19 bbl./min @ 1100 psig

C. Injection rates and pressures

1. Rate

Date(s) Sept. 1966 Average 600,000 gal/day Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

2. Pressure (well head ______ bottom hole ______)

Date(s) Sept. 1966 Average 1220 psig Maximum 1270 psig

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

Accum. vol. to July 1, 1971 - 446,422,700 gal.

X. Well operation & operating history

D. Description of operating programs: continuous while operating at [illegible] psig

E. Operating problems. injection tubing failures Corrosion. April [illegible] 19[illegible]: back flowed. [illegible] [illegible] casing out of ground (25') repair and [illegible] Dec. [illegible] 19[illegible]

XI. Regulatory aspects.

A. Construction requirements standard specifications for corroding casings

B. Monitoring requirements pressure and volume records be kept.

C. Restrictions on operating procedure Change pumping to prevent surging (discharge waste line)

XII. Economics

A. Total and unit costs of construction ≈ 1,250,000 for 3 wells

B. Operating costs 150,000 P.A. 3 wells

XIII. Source(s) of Information and Published References

Pennsylvania Department of Environmental Recourses

WELL FILE NUMBER

Penn. Permit
STATE ERI-109

Pa-3
UMR

I. **Operating Company & General Well Location**

Hammermill Paper Co.

Erie, Pa.

II. **Well location (legal description)**

Location: Erie Co., City of Erie, 42° 08' 33" N,
80° 02' 52" W

III. **History; system planning, construction & operation.**

Well spudded - 7/30/64

Well completed - 8/29/64

Injection started - 1965

IV. Geology & Geohydrology

A. Regional geologic setting: At foot of Portage Escarpment glaciated Allegheny Plateau. Upper Devonian shales at spud. Strike east-lowdip to south.

IV. Geology & Geohydrology, continued 2.

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ✓; no____).

(Ground elevation 650') (Total well depth 5972')

Datum for depth measurement ______________________

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Dev. shales & silts	Dev.	surface	1392'	shale & silt
Onondaga	Dev.	1392'	266'	limestone
Bass Island	Silurian	1658'	74'	limestone, chert
Salina	Silurian	1732'	570'	Gyps., anhyd., ls., some s
Clinton-Albion	Sil.	2312'	303'	limestone some sand
*Gatesburg	Cambrian	5096'	422'	dolomite
Eau Claire	Cambrian	5586'	328'	dolomite
Mt. Simon	Cambrian	5914'	38'	sandstone

-dovician

2615'

: 2481'

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Bass Islands	Silurian	1658'	74'	dolomite
Mt. Simon	Cambrian	5914'	38'	sandstone

D. Engineering description of injection units

1. Porosity: N.A.
2. Permeability: N.A.
3. Original Reservoir Pressure: N.A.
4. Reservoir Temperature: N.A.
5. Chemical Character of Formation Water: samples from basal zones do not appear to be native brines. The Bass Island appear to be diluted.
6. Reservoir Fracture Pressure: ______________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

no shallow aquifer
several deeper zones are presumably saline
including Bass Islands and Cambrian

F. Mineral Resources (oil and gas, coal, brines, etc.)

Usual sedimentary sequences & brines. Nothing of known present economic value.

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight	& grade & type	Size	Depth Set	Type & Amount of Cement
Surface	17"	54#	H-40	13 3/8"	79'	"A" Portland 85 sks
Intermed.	13"	36#	J-55	9 5/8"	2538'	"A" Port. 950 sks
	9"	26#	J-55	7"	5100'	"A" Port 480 sks
Injection		16#	J-55	5"	5972	
		16#	N-80	5'	1600'	to top of Bass Is

Other

Describe bottom hole completion method: lined open hole in Mt. Simon

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: model "D" Baker packer at 1600' perf. 1620-1710

VI. Description of surface equipment

A. Holding tanks & flow lines 6 Batch tanks 4-100,000 gals and 2 of 50,000 gal. capacity. One surge tank

B. Filters rotating leaf filters and trap filters prior to injection

C. Pumps reciprocating pumps at time of installation

D. Other

VII. Cores, samples, & Logs

A. Coring

From	5104.0	to 5111.01	Recovery 100%
"	5184.0	5156.5	less than
"	5547	5559.6	100%
"			
"			
"			

B. Drilling Logs

___ Drillers Log

✓ Sample log

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

- ✓ Resistivity
- ✓ SP
- ✓ Caliper
- ✓ Gamma ray-neutron
- ✓ Temperature
- ✓ Cement bond
- ___ Other *not on file in state office*

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Paper mill digestor liquors (sulphite & lignins)

B. Physical & chemical Description *Spent sulfite pulping liquor containing fiber, fiber fragments, paper filler materials such as clay and TiO_2, and lignin-like compounds in the colloidal and semi-colloidal size range.*

Sp.Gr. - 1.02 *Total SO_4 - 1.75 mg/l*

pH - 5.3 *Cl. - 270 mg/l*

T.D.S - 5.0%

NH_3 - 0.0

C. Volume ___

IX. Preinjection waste treatment *filtration*

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Cambrian	acid	none indicated
	water frac	19000 gal · 9 bbl/min @
		1500 psig ; 15 bbl/m @ 1700 psi
Bass Islands	acidic & water	6 to 15 bbl/min @ 1100 psig

C. Injection rates and pressures

1. Rate

Date(s)	Average	Maximum
Sept. 1966	600,000 ga/[illegible]	650,000 gal.
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ____________ bottom hole ____________)

Date(s)	Average	Maximum
Sept. 1966	1350	1520 psig
"	"	"
"	"	"
"	"	"
"	"	"

total July 1965 to Sept. 1968 - 297,872,300 gal.

X. Well operation & operating history

D. Description of operating programs: continuous operation until shutdown in Sept. 1968

E. Operating problems: N.A.

XI. Regulatory aspects.

A. Construction requirements permit requirements approved by SWB

B. Monitoring requirements continuous

C. Restrictions on operating procedure N.A.

XII. Economics

A. Total and unit costs of construction ________

1,250,000 for 3 wells

B. Operating costs 150,000 /yr. 3 wells

XIII. Source(s) of Information and Published References ________

Pennsylvania Department of Environmental Resources
Very little detailed operative ~~data~~ info on file

WELL FILE NUMBER

Penn. Permit
STATE BED 39

Pa-4
UMN

I. Operating Company & General Well Location

Gulf Research and Development

Pittsburgh, Pa.

Well is located 6 miles south of Bedford

II. Well location (legal description)

Location: Bedford Co., Colerain Twp. 29,400 S of 40° 00',
21,700' W of 78° 25'

III. History, system planning, construction & operation.

Well spudded - 8/64

Well completed - 12/64

Injection started - 12/64

Well plugged - 3/71

IV. Geology & Geohydrology

A. Regional geologic setting: Paleozoic bedrock - area highly folded - Valley and Ridge Province

Very little information available concerning the geology in the area of the well site.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ___; no ✓).

(Ground elevation 1255') (Total well depth 562')

Datum for depth measurement ______

Name	Age	Depth (top)	Thickness	Lithologic Description
N.A.				

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thickness	Character and Areal Distribution
Bellefonte	Ordovician	≈550	15'	dolomite

D. Engineering description of injection units

1. Porosity: N.A.
2. Permeability: N.A.
3. Original Reservoir Pressure: N.A.
4. Reservoir Temperature: N.A.
5. Chemical Character of Formation Water: Fresh water with total dissolved solids content of 274 ppm
6. Reservoir Fracture Pressure: ______

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality
	N.A.			

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			6 5/8	545	3 sks.
Intermed.			4 1/2	540	30 sks
Injection					
Other					

Describe bottom hole completion method: Open hole 5 1/8 in from 545-562 ft

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: N.A.

VI. Description of surface equipment

A. Holding tanks & flow lines N.A.

B. Filters N.A.

C. Pumps N.A.

D. Other N.A.

VII. Cores, samples, & Logs

A. Coring

From ---- to ---- Recovery

"

"

"

"

"

B. Drilling Logs

___ Drillers Log ___ Drilling time

___ Sample log ___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity

___SP

___Caliper

___Other

___Gamma ray-neutron

___Temperature

___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Experimental drilling operations

B. Physical & chemical Description

bentonite drilling muds.

C. Volume N.A.

IX. Preinjection waste treatment N.A.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
Bellefonte dol. 555 - 562	acid frac.	8500 gal. @ 420 gal/min.

C. Injection rates and pressures

1. Rate

Date(s) N.A. Average ______ Maximum ______

" injection rate ranged from 0 to 22,000 gpd

" well used only periodically during 1964-1971

" ______ " ______ " ______

" ______ " ______ " ______

2. Pressure (well head 500-600 psi bottom hole ______)

Date(s) N.A. Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

X. Well operation & operating history

D. Description of operating programs: N.A.

E. Operating problems: The well was alleged to be the source of contamination of a water well and was subsequently abandoned

XI. Regulatory aspects.

A. Construction requirements N.A.

B. Monitoring requirements N.A.

C. Restrictions on operating procedure N.A.

XII. Economics

A. Total and unit costs of construction N.A.

B. Operating costs N.A.

XIII. Source(s) of Information and Published References

Pennsylvania Dept. of Environmental Recourses

WELL FILE NUMBER — Penn. (STATE) — Pa-5 (UMR)

I. **Operating Company & General Well Location**

Bethlehem Steel Co.

Franklin Boro, Pa.

II. **Well location (legal description)**

Location: Franklin Boro, Cambria Co., Penn.; northeast of Johnstown, Pa.

III. **History; system planning, construction & operation.**

Well completed - 1/66

Well plugged - probably plugged in 1966 after initial testing.

IV. Geology & Geohydrology

A. Regional geologic setting:

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ✓; no ____).

(Ground elevation 1245) (Total well depth 815?)

Datum for depth measurement ________

Name	Age	Depth (top)	Thick-ness	Lithologic Description

C. Geologic Description of injection units & possible units not in use

Rock Unit Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Burgoon (Pocono Fm.)	Mississippian			sandstone

D. Engineering description of injection units

1. Porosity: ________
2. Permeability: ________
3. Original Reservoir Pressure: ________
4. Reservoir Temperature: ________
5. Chemical Character of Formation Water: at 570 feet 104,000 ppm total dissolved solids
6. Reservoir Fracture Pressure: ________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			16 in	61 ft	
Intermed.			10 3/4 in	210 ft	
			7 in	570 ft	
Injection					
Other					

Describe bottom hole completion method: 6 3/4 in open hole from 570 ft to 845 ft

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: ____

VI. Description of surface equipment

A. Holding tanks & flow lines ____

B. Filters ____

C. Pumps ____

D. Other ____

VII. Cores, samples, & Logs

A. Coring

From	to	Recovery
"		
"		
"		
"		
"		

B. Drilling Logs

✓ Drillers Log attached ____ Drilling time

___ Sample log ____ Other: ____

VII. -- Cores, samples, & logs, continued

C. Other logs run

____Resistivity ____Gamma ray-neutron

____SP ____Temperature

____Caliper ____Cement bond

____Other ____________________

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

Weak ammonia liquor from coke plant

B. Physical & chemical Description

9000 ppm ammonia
200 ppm hydrogen sulfide
2600 ppm phenols
6000 ppm Chloride

C. Volume 100 gpm

IX. Preinjection waste treatment

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
injectivity		Burgoon	130 gpm 750 psi
			180 gpm 600 psi

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results

C. Injection rates and pressures — well failed at initial operation

1. Rate

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

2. Pressure (well head ______ bottom hole ______)

Date(s)	Average	Maximum
"	"	"
"	"	"
"	"	"
"	"	"

X. Well operation & operating history

D. Description of operating programs:

E. Operating problems: Well plugged during initial operation and was abandoned

XI. Regulatory aspects.

A. Construction requirements

B. Monitoring requirements

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Pennsylvania Department of Health

WASTE DISPOSAL WELL NO. 1
FRANKLIN PLANT, BETHLEHEM STEEL CO., JOHNSTOWN, PA.

LOG OF DIAMOND DRILL PORTION OF HOLE
P. W. GARRETT AND C. K. [illegible] - NOV. 22, 1950

DEPTH	DESCRIPTION (ALL AX CORE)
572-577	SANDSTONE, LIGHT GRAY, FINE-GRAINED, NON-CALCAREOUS, MICACEOUS.
577-581	SAND, WITH OCCASIONAL SHALY PARTINGS.
581-587	SANDSTONE, SLIGHTLY DARKER THAN ABOVE, AND MORE MICACEOUS.
587-599	SILTY SANDSTONE, DARK GRAY, DENSE.
599-603	SANDSTONE, WHITE TO LIGHT GRAY, MICACEOUS, WITH VERY THIN SHALE PARTINGS. POOR RECOVERY IN SHALE [illegible] FROM [illegible] TO 599'.
603-610	SANDSTONE, MEDIUM TO FINE GRAINED, WITH INCREASED SHALY PARTINGS. PROMINENT SHALE AT [illegible].
610-620	SHALE, MEDIUM GRAY; SILTY [illegible] AT 616. SILT INCREASES BELOW 615.
620-622	SHALE, WITH THIN [illegible] LENSES.
622-623	SANDSTONE, MEDIUM GRAINED, MEDIUM GRAY, VERY LITTLE MICA, AND SOME IRON HYDROXIDES.
623-625	SANDY SHALE, ABUNDANT IRON OXIDE STAINING AT BOTTOM.
[illegible]	[illegible], VERY [illegible], [illegible].
[illegible]	[illegible], FINE GRAINED, MEDIUM GRAY, MASSIVE, NO PARTINGS.
[illegible]	[illegible], MEDIUM GRAINED, OCCASIONAL SHALY PARTINGS.
[illegible]	SANDSTONE, MEDIUM TO COARSE, MASSIVE, NO SHALE PARTINGS IN THE CORE.
[illegible]	[illegible], [illegible].
[illegible]	SANDSTONE, [illegible] SHALE PARTINGS AND VERY THIN COALS..
[illegible]	SANDSTONE AS ABOVE, FINE GRAINED, [illegible] COAL PARTINGS.
[illegible]	[illegible] SHALE FRAGMENTS. INTRA-FORMATIONAL [illegible].
[illegible]	SANDSTONE WITH THIN SHALY PARTINGS.
[illegible]	[illegible], MEDIUM FINE GRAINED.
[illegible]	SANDSTONE, [illegible], MEDIUM GRAINED.
[illegible]	SANDSTONE, MEDIUM TO FINE GRAINED, MASSIVE.

[illegible]-659	SANDSTONE, MEDIUM TO COARSE, ABUNDANT SHALY PARTINGS WITH A LITTLE COAL; SHALE FRAGMENTS IN INTRAFORMATIONAL CONGLOMERATE. DIPS 20°.
659-665	SANDSTONE, VERY FINE GRAINED, GRAY, MASSIVE.
665-673	SAME, BUT A LITTLE DARKER COLOR.
673-691	SANDSTONE, CROSS BEDDED, POROUS. MANY SHALE PARTINGS WITH OCCASIONAL COAL PARTING. DIPS 20°.
691-692	BLACK SHALE, DENSE.
692-703	SANDSTONE, MEDIUM FINE GRAINED, MASSIVE. FAINT PARTINGS AT 695, POOR CORE 692' TO 703'.
703-720	SANDSTONE, MEDIUM TO COARSE, LIGHT GRAY, MASSIVE. SOME SHALE FRAGMENTS AT 712'.
720-731	SANDSTONE, FINE GRAINED, SILTY, DENSE. OCCASIONAL COARSE BAND BUT NOT POROUS.
731-740	SANDSTONE, MEDIUM FINE GRAINED, OCCASIONAL SHALE PARTING.
740-743	SILTY SANDSTONE.
743-750	SILTSTONE, DARK GRAY, DENSE WITH INTERBEDDED FINE GRAINED SANDSTONE. LENSES ARE ABOUT 1" THICK. ABUNDANT MICA.
750-757	SANDSTONE, MEDIUM GRAINED, DENSE.
757-763	SANDSTONE, COARSE GRAINED, INCREASING POROSITY.
763-775	INTERBEDDED SILTSTONE AND SHALE, DARK GRAY. SOME INTRAFORMATIONAL CONGLOMERATE.
775-785	SHALE, DARK GRAY, DENSE, WITH THIN SILTY LENSES.
785-800	SANDSTONE, VERY FINE GRAINED, SOME TIGHT PARTINGS. OCCASIONAL SHALE CONGLOMERATE ZONE.

CC - PULLEN
SYKES
GARRETT, PHC
EATON

WELL FILE NUMBER

Penn. Permit
STATE BUT 584

Pa-6 / UMR

I. Operating Company & General Well Location

Koppers Company, Inc.
Petrolia, Pa. - plant occupies a small portion of the central and northern areas of the Petrolia city limits

II. Well location (legal description)

Butler Co., Fairview Twp.
[illegible]' South of 41°05'
[illegible]' West of 79°40'

III. History, system planning, construction & operation.

well contracted - 6-22-69
well completed - 8-12-69
well testing - 8-25-69
injection started - 9-24-69

plugged back to 2990 because of absence of potential disposal zones below this depth.

IV. Geology & Geohydrology

A. Regional geologic setting: Bedrock in the area of Petrolia Pa. consists of Upper and Middle Pennsylvanian strata. (Conemaugh & Allegheny form. resp.) This area is located within the Appalachian Plateaus Province west of the closely folded & faulted Valley and Ridge. Regional dip is S-SE at 50'/mile w/ local minor folding.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes____; no ✓).

(Ground elevation 1163') (Total well depth 3103')

Datum for depth measurement ____________

Name	Age	Depth (top)	Thickness	Lithologic Description
Van Port	Pennsyl.	96'	12'	limestone
Shenango	Mississipp.	603'	71'	Sandstone
Riceville	Devonian	830'	116'	shale
Venango 1st	Dev.	916'	50'	Sandstone
Venango 2nd	Dev.	1030'	132'	Sandstone
Knox 3rd	Dev.	1206'	34'	Sandstone
Warren 1st	Dev.	1818	32'	Sandstone
Speechly	Dev.	2152	32'	Sandstone

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thickness	Character and Areal Distribution Porosity
Venango 2nd Sandstone		1030-1152		3 to 18%
Knox 3rd Sandstone		1206-1240		2 to 16%
Knox 4th Sandstone		1246-1264		3 to 15%
Venango 3rd Sandstone		1316-1344		5 to 14%
Warren 1st Sandstone		1818-1850		1 to 6%
Warren 2nd Sandstone		1902-1908		6%
Queen Sandstone		2040-2046		2 to 4%
Speechley Sandstone		2152-2182		2 to 15%

primary zones

D. Engineering description of injection units

1. Porosity: see above ---
2. Permeability: ____________
3. Original Reservoir Pressure: ____________
4. Reservoir Temperature: ____________
5. Chemical Character of Formation Water: Total dissolved solids at 435 ft. 3830 mg/l at 1116-1136 ft 4,332 mg/l. Analysis at 1116-1136 ft 1,460 mg/l Na; 147 mg/l Ca; 2450 mg/l Cl; 252 mg/l HCO_3; 29 mg/l Mg; 4 mg/l SO_4
6. Reservoir Fracture Pressure: ____________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

Results of tests indicate that fresh or potable water does not exist in this area beneath the Pennsylvanian series of strata. Total dissolved solids in sandstone at 455' was 9990 mg/l.

F. Mineral Resources (oil and gas, coal, brines, etc.)

during drilling oil and gas shows were detected in the following intervals: Venango 3rd sandstone

Knox 3rd and 4th ss.

Venango 3rd sandstone

gas show in [illegible] ss at 2173

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface			13 3/8	42	
Intermed.		33# N-40	10 3/4	435	Pozmix 150 sks.
			5 1/2	2275	Pozmix A 650 sks.
Injection			2 7/8	1006	
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: Otis packer at 1026'

VI. Description of surface equipment

A. Holding tanks & flow lines two 10,000 gal holding tanks

B. Filters dual sand filters

C. Pumps dual triplex plunger pumps w/ a fluid end constructed of corrosion resistant metal.

D. Other control and monitoring equipment

VII. Cores, samples, & Logs

A. Coring

From N.A. to ______ Recovery ______

B. Drilling Logs

✓ Drillers Log

✓ Sample log

___ Drilling time

___ Other: ______

VII. -- Cores, samples, & logs, continued

C. Other logs run

✓ Resistivity ✓ Gamma ray-neutron

✓ SP ___ Temperature

✓ Caliper ___ Cement bond

___ Other SNP, Sonic, Dual Induc. Laterlog

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

coal tar processing and coke manufacturing

B. Physical & chemical Description sodium sulfate - sulfide effluent containing minor amounts of phenolics

C. Volume N.A.

IX. Preinjection waste treatment

N.A.

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results
injectivity	5½ hrs	injection zones	about 40 gpm at 2250 psi
"	4 hrs	"	about 80 gpm at 2200 psi
"	2 hrs	"	about 125 gpm at 2200 psi
"	1 hr	"	about 210 gpm at 2600 psi

increasing injectivity rate probably a result of hydraulic fracturing as described below

B. Treatments or Stimulation

Zones Treated — Treatment Method — Description of Treatment and Results

[illegible]

Depth	Breakdown Pressure	Treating Pressure	Water Volume	Sand Volume
1827-1837	4050 psi	Did not treat	None	None
1907	3175 psi	3600 psi	[illegible]	6500#
2044	3500 psi	Did not treat	None	None
2160-2170	3900 psi	3700 psi	[illegible]700 gal.	5400#

C. Injection rates and pressures

1. Rate

Date(s) N.A. Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

2. Pressure (well head ______ bottom hole ______)

Date(s) N.A. Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

X. Well operation & operating history

D. Description of operating programs: N.A.

E. Operating problems:

XI. Regulatory aspects.

A. Construction requirements N.A.

B. Monitoring requirements N.A.

C. Restrictions on operating procedure

XII. Economics

A. Total and unit costs of construction N.A.

B. Operating costs

XIII. Source(s) of Information and Published References

Pennsylvania Dept. of Environmental Resources

WELL FILE NUMBER

Temp. Permit
STATE LS-WAS-1

Pa-7
UMR

I. Operating Company & General Well Location

Bethlehem Steel Co.

Marianna Pa.

II. Well location (legal description)

Location: Washington Co., Marianna Boro Twp.

III. History, system planning, construction & operation.

Well Spudded - 9/14/6[illegible]

Well Completed - [illegible]

The well was tested in 1966, but tests were unsuccessful and the well was never operated.

IV. Geology & Geohydrology

A. Regional geologic setting: Dunkard rocks at surface in axis of Appalachian Basin (Pittsburgh-Parkersburg) syncline.

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ✓; no ___).

(Ground elevation 933') (Total well depth 1588')

Datum for depth measurement ___

Name	Age	Depth (top)	Thick-ness	Lithologic Description
see attached columnar log				

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
other units above salt sand did not appear favorable.				
Salt Sands	Pennsylvanian	1431'	61'	widespread sandstones but discontinuous

D. Engineering description of injection units

1. Porosity: 4.5 - 10.0%
2. Permeability: 0 - 128 md. by core analysis
3. Original Reservoir Pressure: ___
4. Reservoir Temperature: ___
5. Chemical Character of Formation Water:
   pH 8; acidity 0; alkalinity 570; Fe 1.0; SO_4 8.0
   Ca 47.0; Cl 3118 (all in ppm.)
6. Reservoir Fracture Pressure: ___

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thick-ness	Character	Chemical Quality
	none			

F. Mineral Resources (oil and gas, coal, brines, etc.)

coal

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing: Weight & grade	Size	Depth Set	Type & Amount of Cement
Surface	20"	J-55	16"	20'	Portland
Intermed.		H-40	10"	532'	"
		J-55	7"	1802'	"
Injection	no tubing used				
Other					

Describe bottom hole completion method: open hole

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: not completed

VI. Description of surface equipment

A. Holding tanks & flow lines 1,500,000 holding pond

B. Filters not completed

C. Pumps "

D. Other "

VII. Cores, samples, & Logs

A. Coring

From 1302 to 1558 Recovery 271 (15' lost)

B. Drilling Logs

✓ Drillers Log

✓ Sample log

Drilling time

Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity

___SP

✓ Caliper

___Other velocity, guard

✓ Gamma ray-neutron

✓ Temperature

___Cement bond

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

mining of coal

B. Physical & chemical Description

waters contain $FeSO_4$ & H_2SO_4

C. Volume no injection

IX. Preinjection waste treatment no injection

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1508'	Fracture	1600 psi
1882'	Fracture	3000 psi

zones determined from Gamma-Ray log.
1302-1588' water injection pumped to pressure of 1550 psi @ 84 gpm; pressure to 1220-1800 psi @ 160 gpm; pressure to 1825-1840 psi yields flows of 28-218 gpm.

C. Injection rates and pressures

1. Rate

Date(s) test only see above Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

2. Pressure (well head ______ bottom hole ______)

Date(s) ______ Average ______ Maximum ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

" ______ " ______ " ______

X. Well operation & operating history

D. Description of operating programs: did not operate

E. Operating problems: experimental: fresh water injection only - well failed in open hole - declining efficiency

XI. Regulatory aspects.

A. Construction requirements none

B. Monitoring requirements none

C. Restrictions on operating procedure none

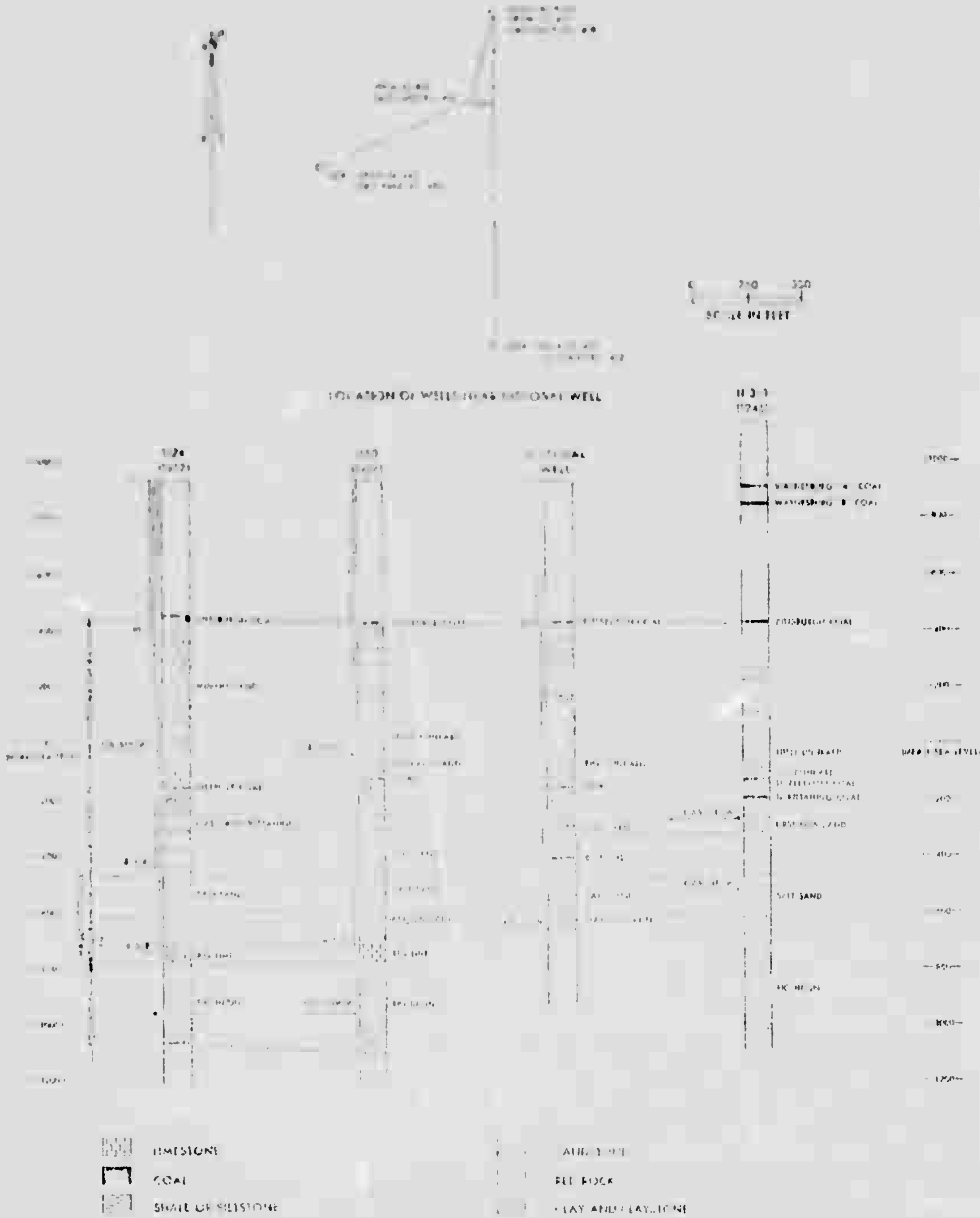
XII. Economics

A. Total and unit costs of construction $57,079 not including Buckingham's administrative costs

B. Operating costs

XIII. Source(s) of Information and Published References

Pennsylvania State University "Development of an injection well for subsurface disposal of acid mine water." Penn. Coal Research Board Special Report 60, Feb. 1, 1967



PARTIAL LOGS OF WELLS IN THE VICINITY OF MARIANNA DISPOSAL WELL
Figure 10

WELL FILE NUMBER Penn. Permit STATE LS-EBT-2 Pa-8 UMR

I. Operating Company & General Well Location

Hammermill Paper Co.

Erie, Pa.

II. Well location (legal description)

Location: Erie Co., City of Erie 42° 08' 26" N

80° 02' 59" W

III. History, system planning, construction & operation.

Well Spudded - 5/10/68

Well Completed - 5/15/68

Very little information is available on this well.

It is reported as an operating well.

IV. Geology & Geohydrology

A. Regional geologic setting: See wells 1 and 2

IV. Geology & Geohydrology, continued

B. Geologic description of rock units penetrated by well

Rock Unit (Geologic Column included--yes ✓; no ____).

(Ground elevation 647') (Total well depth 2354')

Datum for depth measurement ____________

Name	Age	Depth (top)	Thick-ness	Lithologic Description
Onondaga	Devonian	1395'	201'	limestone ē chert
Bass Islands	Silurian	1586'	151'	dolomite ē limestone
Salina	Silurian	1737'	365'	gyps, anhyd, salt, b. [illegible]
Lockport	Silurian	2102'	218'	dolomite
Clinton-Albion	Silurian	2320'	34'	sandstone w/ some shale

C. Geologic Description of injection units & possible units not in use

Rock Unit

Name	Age	Depth (top)	Thick-ness	Character and Areal Distribution
Bass Islands	Silurian	1586'	151'	vuggy dolomite ē limestone

D. Engineering description of injection units

1. Porosity: N.A.
2. Permeability: ____________
3. Original Reservoir Pressure: ____________
4. Reservoir Temperature: ____________
5. Chemical Character of Formation Water: ____________
6. Reservoir Fracture Pressure: ____________

IV. Geology & Geohydrology, continued

E. Geohydrology; fresh water aquifers in vicinity

Name	Depth	Thickness	Character	Chemical Quality

F. Mineral Resources (oil and gas, coal, brines, etc.)

V. Well design and construction

A. Casing, Tubing, and Cement

	Hole Size	Casing or Tubing Weight & grade Pipe Size		Depth Set	Type & Amount of Cement
Surface			13 3/8"	58'	100 sks.
Intermed.			9 5/8"	1393'	300 sks.
			7"	2179'	435 sks.
Injection			5"	1601'	160 sks.
Other					

Describe bottom hole completion method:

V. Well design and construction, continued

B. Packers, Centralizers, well head equipment, etc: N.A.

VI. Description of surface equipment

A. Holding tanks & flow lines N.A.

B. Filters N.A

C. Pumps N.A

D. Other N.A

VII. Cores, samples, & Logs

A. Coring

From	N.A.	to	Recovery
"			
"			
"			
"			
"			

B. Drilling Logs

✓ Drillers Log

___ Sample log

___ Drilling time

___ Other:

VII. -- Cores, samples, & logs, continued

C. Other logs run

___Resistivity	___Gamma ray-neutron
___SP	___Temperature
___Caliper	___Cement bond
___Other___	

VIII. Waste Characteristics

A. Industrial Process from which waste is derived

See Pg-2 & Pg-3

B. Physical & chemical Description See Pg-2 & Pg-3

C. Volume ___

IX. Preinjection waste treatment ___

X. Well operation & operating history

A. Tests

Type	Duration	Zones tested	Description of test results

B. Treatments or Stimulation

Zones Treated	Treatment Method	Description of Treatment and Results
1620-1720	acid frac.	15000 gal. of HCl and
Bass Islands		2000 lb. of rock salt maximum
		2150 psi broke to 1300 psi

C. Injection rates and pressures

1. Rate

Date(s) ______ Average ______ Maximum ______

2. Pressure (well head ______ bottom hole ______)

Date(s) ______ Average ______ Maximum ______

X. Well operation & operating history

D. Description of operating programs: ______________________

E. Operating problems: ______________________

XI. Regulatory aspects.

A. Construction requirements ______________________

B. Monitoring requirements ______________________

C. Restrictions on operating procedure ______________________

XII. Economics

A. Total and unit costs of construction

B. Operating costs

XIII. Source(s) of Information and Published References

Penn. Dept. of Environmental Resources